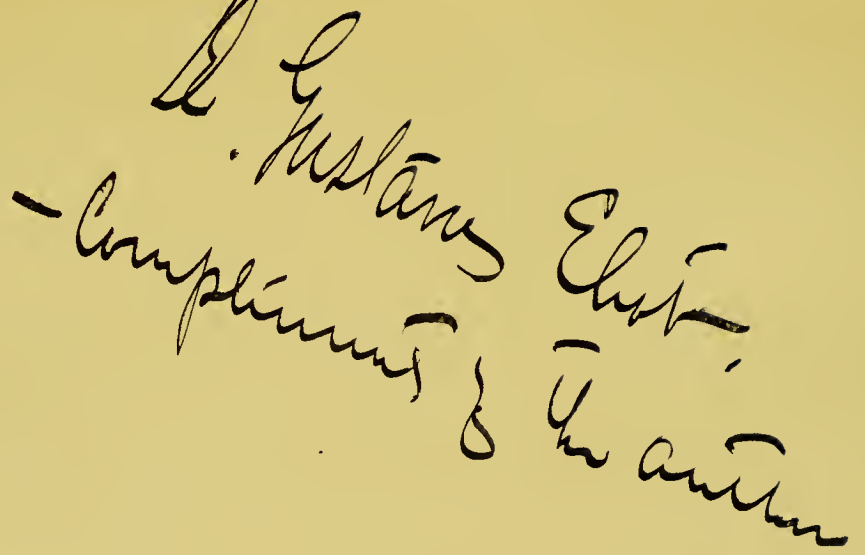
How We Treat Wounds To-Day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HOW WE TREAT WOUNDS TO-DAY

A TREATISE ON THE SUBJECT OF ANTISEPTIC SURGERY WHICH CAN BE UNDERSTOOD BY BEGINNERS

BY

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NEW YORK & LONDON
G. P. PUTNAM'S SONS
The Knickerbocker Press
1886

Press of
G. P. Putnam's Sons
New York

FIRST WORD.

This book is modest only in size.

It possesses dignity only in its facts.

There is little of originality in what it teaches.

My idea is to present in digestible form a dish of truth from which all bones have been removed.

Experts discuss modifications of Listerian principles.

The rank and file of the profession are too busily engaged in practice to be able to follow these leaders.

No one plan of action has been separately detailed, and so the great cause suffers.

I shall attempt to describe concretely the way in which a few wounds should be treated.

Extensiveness will be sacrificed to simplicity.

The surgeons who are masters of Antiseptic

Science will learn little from what I have written here.

Other surgeons will find themselves placed hand and foot on the ladder which leads up to the expert's position.

These pages can not teach principles. I will give you facts and you may deduce principles a posteriorily.

If enough potential mental energy be developed out of the facts to enable stragglers to capture the truths contained in the literature of Antiseptic Surgery, my object in writing is gained.

THE CUMBERLAND, 945 BROADWAY,
July 1, 1885.

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HOW WE TREAT WOUNDS TO-DAY.

CHAPTER I.

Let us build upon the following syllogism which is not of sand.

All surgeons who understand antiseptic wound treatment work antiseptically.

Not all surgeons work antiseptically.

Therefore, not all surgeons understand antiseptic wound treatment.

The premises may be challenged by men who do not work antiseptically, but at the bottom of the trouble is rather the method of the individual than any fault in the antiseptic method.

Some men who stand high in the profession have expressed themselves as opposed to the new and scientific way of treating wounds, but this is in fact because they have not had ex-

perience with clinical demonstrations of genuine antisepsis and its results.

Students sometimes excuse themselves from an acquaintance with modern methods because a certain professor in surgery, for whom they have great respect, has not made himself, familiar with the subject.

Because Cato learned Greek at the age of eighty years very few of us are inclined to think that the Greek language was previously unknown ; and the professor and his students will find that time will break down their opposition, or, in other words, will supply their lack of information.

Lack of information in this connection means that opportunity for learning has not been given ; and this opportunity has not been widely given in America, because teachers have been too few, and because the text-books on the subject of antiseptic surgery have been too elaborate for beginners.

In a few years this country will do as good or better surgical work than Germany is now doing, but in the meantime patients and physicians will experience much suffering and

disappointment where comfort and satisfaction might be had.

The history of antiseptic surgery is not different from the history of previous radical advances in civilization.

At present the brightest lights in the profession form the head of the comet, while stringing out into the tail are multitudes who can never change their positions.

In order to fully comprehend our modern wound treatment, one must have a knowledge of the life-histories of micro-organisms; although a simple appreciation of the fact that microbes are continually on the alert for free board and lodging would be sufficient to put most men on guard against them.

If you shake a puff-ball the air in the vicinity is filled with spores, which become new puff-balls so soon as circumstances favor.

If a septicæmia patient should be shaken, the air would in the same way be filled with spores, which would proceed to make new septicæmia microbes at the very first opportunity.

The micro-organisms, in different stages of

development, which are constantly floating about us are successful monopolists ; and they betake themselves with their families to any spot where a bit of fertile territory is opened up—appropriating all food products within reach.

Expose fresh apple juice to the air and micro-organisms will fall into it.

The species which are fond of the sugar increase most rapidly, and demanding part of the elements of the sugar molecule, allow the remaining atoms to arrange themselves into alcohol and so-called carbonic-acid gas.—Cider results.

Other species which grow more slowly proceed to attack the alcohol, and leave acetic acid in its place.—Vinegar results.

When a large wound is exposed to the air many microbes are made happy, and the species which feed upon the albuminous discharges begin work at once ; destroying the plastic lymph which is thrown out, and leaving sulphur-alcohols and ethers in their trail.

The wound has taken on new life, but not the kind of new life which we wanted ; and

irritation, caused by the microbe growth, forces nature to resort to a subterfuge in order to heal.

How the old pathologists did love to see an abundance of "laudable pus"! believing that its presence with granulating surfaces was a thing to be desired.

Ordinarily, suppuration and undue local inflammation are the worst results of the growth of micro-organisms; but if any septicæmia or pyæmia, or erysipelas spores happen to be about, they claim a share of the spoils, and not content with what is set before them, break into and mob the general commissary department of the patient.

We have, however, the power to prevent the growth of such micro-organisms in wounds.

When the surgeons of earlier days used balsams and essential oils in their dressings, an approximation to the condition of antiseptics was brought about.

When carbolic acid came into vogue, an improvement in wound treatment followed, because carbolic acid was a better antiseptic substance than oil or balsam.

Bichloride of mercury has proved to be a better germicide than carbolic acid.

Not until Sir Joseph Lister poured together into his large crucible, extracts from green-growing theories and from cut and dried facts, did the pure crystals of antiseptic science appear.

Lister it was who first taught us to apply systematically and accurately a method which would ensure for our wounds protection against the hordes of intriguing microbes, and although his particular method has been simplified and superseded in other countries, the underlying principles remain the same, and subtend all the modifications of the improvers.

To the prime mover in London is due the credit of giving to the world a better means for preventing suffering than has ever before been given by any one man. There are men, of course, who will object to this claim; but you cannot argue constitutional law with a hod-carrier. Neither can you avoid hearing the fire-crackers which pop while the boom of the cannon is reverberating.

It is now possible to gain primary union in almost. all wounds ; and operators who work antiseptically believe as causators that primary union goes not by luck but by law ; and further, that they are able to inhibit breakers of the law.

Mr. Lister believed his wounds to be aseptic, and the belief has caused greater dispute than its importance warrants ; for whether or not microbes are present in a wound, is a matter of no importance, provided that their growth be so hindered that natural reparative processes are not interfered with.

It seems to me that the word *antiseptic* is a better word than *aseptic* as a qualifying adjective.

At the present day we control microbe growth with substances which in themselves cause so little disturbance to the wound that danger from them is seldom to be feared. For instance, among hundreds of wounds which I have seen in this and in other countries, which were treated with bichloride of mercury, only one serious case of poisoning has been produced.

That case was furnished by a patient of my own, and the accident will not occur again, although I shall continue to use bichloride of mercury until a better material can be substituted for it.

The patient in question will be referred to again in another chapter.

A localized eruption of the skin, caused by the carbolic acid or bichloride of mercury used in dressings, will appear in perhaps five per cent. of our cases, but it amounts to nothing, and is preferable to untimely eruption of the spirit.

Think of the numbers of patients in whose wounds antiseptics make no unwished for demonstration.

Every thing in this world is comparative.

Think of the numbers who formerly suffered and died from septic infection, or from the effects of prolonged suppuration, because antiseptic treatment was omitted.

Surely sins of omission may be greater than sins of commission in surgery.

Do we deprive patients of an anæsthetic because deaths have occurred during anæsthesia?

Most assuredly not.

If deaths from such a cause are placed in the balance with deaths from shock where an anæsthetic was not employed, which side do we find the heavier?

If we put deaths from corrosive-sublimate poisoning on one side of the balance, and deaths from wound infection on the other side, the latter go down with such a thump that the former are hurled high in air and scattered to the winds.

A mild statement is made when we say that more misery can be avoided by actual scientific antisepsis surgery than by anæsthesia.

Many shadows are thrown on actual scientific antiseptic by men who suppose that they are doing orthodox work when they are really doing nothing of the sort. These operators hurt the reputation of the cause.

If an operation should be performed when an anæsthetic had carried the patient to the stage of excitement only, would an observer believe that anæsthesia was greatly beneficial?

If a surgeon employ corrosive sublimate or carbolic acid in dressing a recent compound

dislocation of the carpus, and is obliged to change the dressings a few days later on account of suppuration, does the spectator carry away a favorable idea of antiseptic treatment?

In either case the fault would lie in the method of the individual, but in each case one who did not know better would take the principle to task.

During the first six months of my service on the house staff of Bellevue Hospital, in the winter of 1882–3, I saw several deaths from pyæmia, septicæmia, and erysipelas.

We believed that our division was doing a great deal of antiseptic work, and although our records were much better than previous ones had been, patients dreaded the very name of the hospital.

In spite of the energetic care of Warden O'Rourke, and in spite of the general cleanliness insisted on by many of the visiting surgeons, the dread diseases were almost continually present in the wards, and we dared operate upon the most urgent cases only.

If varicocele were operated upon at that time by the method of opening the scrotum

widely, ligating the vessels above and below, and snipping out the mass of veins with scissors, the patient would have been almost certain to develop phlebitis.

A year later, and the surgeon who lost such a case from phlebitis would lose caste in the profession, and he would perhaps go back to the clumsy old method of ligating the veins subcutaneously.

Subcutaneous surgery and surgery in the dark are synonymous.

In April, 1883, when Dr. Frederick Lange introduced scientific antisepsis into the wards of the Second Surgical Division of Bellevue Hospital, a very active revolution in wound treatment followed.

Dr. Sands at Roosevelt Hospital, Dr. Weir at New York Hospital, and Dr. Bull at Chambers Street Hospital, in New York, were already acknowledged American leaders in the new surgery.

In July, 1883, Dr. Lange went on duty as Visiting Surgeon to the Fourth Surgical Division of Bellevue Hospital, and in not one case from that time until the end of my service,

in April, 1884, did septicæmia, pyæmia, or erysipelas follow operations or attack accidental wounds.

The profuse suppuration to which we had become accustomed disappeared as if by magic, and instead of spending several hours daily in changing dressings, we employed only a few minutes in that sort of work, the number of operative cases being at the same time very greatly increased.

Patients became enthusiastic and brought friends for us to operate upon, and the house staff exerted themselves to get series of operative cases into the hospital.

We operated aggressively upon every thing which could be operated upon, and we opened the great joints and the peritoneal cavity in the unclean wards.

We employed the permanent dressing in treating our compound fractures.

We wired simple fractures of the patella, washing out the joints, and the wounds healed by primary union.

The wards lost the old-time hospital odor. From a reign of terror we came to a sort of

millennium as regards microbe invasion, and the micro-organism and the wound lay down in peace together with a good antiseptic dressing between them.

Some one will say that this old and infected hospital was very different from a private house, and that in the latter place our rigid enforcement of precautionary measures would not have been required.

Let me ask a question or two right here.

Will you, if you live in the purest and freshest of country air, dare to open the knee-joint of a friend and suture a loose semilunar cartilage in place?

Can you put a dressing on a badly lacerated compound and complicated Potts' fracture and allow that dressing to remain untouched for a month?

Will you treat housemaid's knee or a large cold abscess by the simple method of opening them freely and trimming out the abnormal lining membrane of the cavities?

No! You shiver at the mention if you have not yet learned how to work antiseptically; and yet we will treat the cases in this way, without hesitation, in our infected hospitals.

A celebrated English laparotomist has been loud in his objections to antiseptic wound treatment, and he champions the cause of extraordinary cleanliness, without antiseptics.

In his private hospital and with trained assistants he gives us most excellent statistics, but if he knew how to use antiseptics properly he would give us far better ones yet. His abdominal wounds would look much prettier, and would heal more rapidly, and with fewer complications, if he would only learn how to treat them antiseptically.

If any one class of operations can be done successfully under extraordinary cleanliness alone—the laparotomies form that class.

Why it is, we cannot at present say. But this much we know, that in general surgery results are very mournful when antiseptic treatment is not employed.

The fact remains that laparotomies can be done successfully without the employment of microbe-destroying agents; but given this fact, and how many men are working successfully in abdominal operations without depending upon antiseptics?

Two or three!

Give these two or three men a knee-joint in which the condyles of the femur have been shot through and through by a number forty-four Winchester bullet; and what success would they attain in the way of putting the patient out of danger from inflammation and suppuration?

In a great majority of cases that leg would have to be amputated, and the operators could not avoid exhausting suppuration if it were left on.

We can so manage this wound with antiseptic treatment that the patient will not only retain his limb, but he will have almost no febrile reaction after the operation. And the dressing applied will remain unchanged for several weeks.

Yet these two or three laparotomists have the assurance to tell the general surgeons that antiseptic precautions need not be considered.

It is time that we were done with arguing exceptions instead of principles.

An incalculable amount of mischief is done by these great men, who suffer from astygmatism in one or more of their mental meridians.

They cannot see the moral horizon of their beliefs.

A well-known medical man who has recently been travelling in a foreign country, writes as follows with regard to a certain conversation which he had with a colleague:

"The statement which most impressed me was that of a professor of clinical surgery of more than thirty years' standing,—a man of enormous experience and attached to one of the largest hospitals I visited, who told me that his deliberate conviction had at length been formed, that the so-called antiseptic system had little to commend it save that of being a very successful system of quackery."

Now I happen to know this "professor of clinical surgery" to whom the letter refers.

I am very certain that he has never seen an antiseptic operation in his life, but if he has seen one he had no conception whatever of the nature of the work.

His connection with hospital work is at present as slender as the stem of a maiden-hair fern.

I have seen, in visits to his ward, numerous

cases of septicæmia and pyæmia, and teacupfuls of pus.

To speak charitably of the man I should say —he is too old to learn.

Were he younger it is probable that in time he would come to be a most enthusiastic supporter of antiseptic doctrines.

To-day he jumps away like a frog touched up from behind if the mention of antisepsis be made in his vicinity.

The surgeon who writes says further: "He put it very much in this way. 'That if from time to time, in every few months, the methods are changed, and with each succeeding change strong statements are made that the last development contains the only security, it must inevitably follow that to the public mind there can be security only in the hands of the inventor himself for the complete and successful accomplishment of details.'"

The above explains the extent of knowledge which the two men possess on the subject of antiseptic surgery.

Who, I should like to ask, is authority for the idea that "with each succeeding change

strong statements are made that the last development contains the only security"?

Let me tell both of you, and others who have had no opportunity of familiarizing themselves with the literature of modern surgery, that the supposition expressed above is wholly fallacious and malignant.

Shall we go without watches because different watchmakers are at swords' points as to the details of manufacture?

No! All good watches keep time.

Shall we allow patients to suffer because Doctors Popoff and Bonita are not agreed as to the relative merits of iodoform and of carbolic acid in wound treatment?

No! Decidedly no!

All good antiseptic methods save life and prevent suffering.

It is high time, too, that every American surgeon was at work in the knowledge of that fact.

Mr. Lister has recently received the decoration of the order of knighthood *pour le mérite* from the Emperor of Germany.

The honor was bestowed over the heads

of Langenbeck, Volkmann, and Billroth, and even over the heads of the two or three laparotomists who urge cleanliness as a substitute for antisepsis.

Is the Emperor of Germany in the habit of honoring foreigners in preference to his own distinguished countrymen?

It was hardly through oversight that this thing happened, and never was a better earned knighthood than Lister's.

What men are now doing the advance work in surgery?

Who are the men who are piling up statistics of new and great operations?

The workers in antiseptic surgery. The men who have no fear of inflammation after operations.

Where would McEwen's and Schede's osteotomies stand to-day were it not for antiseptic surgery?

Who would conscientiously do Volkmann's operation for hydrocele, or Miculicz' tarsus exsection, or Petersen's cystotomy, if not assured that septic infection could be prevented?

Could Bruns have reported, in the An-

nouncement for 1884 of the Tübingen clinic, twenty successive excisions of the knee-joint, with primary union under one dressing in nineteen of them, if he had depended upon any method of cleanliness without antisepsis?

What do the uninformed think of Esmarch's statement before the Twelfth German Medical Congress, that out of sixty-three successive major operations at his clinic in ~~Halle~~ Kiel, fifty-eight healed by primary union under one dressing?

Scientific antisepsis is, after all, only an exalted degree of cleanliness; but this exalted degree of cleanliness can be reached through scientific antisepsis alone.

A wound is merely put in such shape that nature can work uninterruptedly.

When we operate on bunions, and charge the patient a couple of hundred dollars for the work which nature does immediately afterward, our consciences are easier than they were in earlier days when we charged the patient four or five dollars for something to put on his bunions, and tried to do the repairing ourselves.

The operation which was really a dangerous one a few years ago has become a very simple one now that inflammation can be prevented.

Objection is often made to the small details in an antiseptic method.

The technique and details go to make up the grand whole, and whoever omits a part of them takes the responsibility upon his own shoulders.

A chain is no stronger than its weakest link. An antiseptic system is no stronger than its weakest detail, which should have been strong.

Many physicians suppose that antiseptic work cannot be readily carried out in private practice, but that hospital facilities must be available.

Let me ask these men if they are going to deprive the literary man, the banker, or the merchant, of the privileges which are accorded the tramp, or the thief who is carried to the hospital?

As will be shown later it is practically no more difficult to do the work in one place than in another.

I have performed in private practice such

operations as ovariotomy, herniotomy, excision of the knee, etc., at short notice, and with not one essential facility wanting for the attainment of antiseptic ends.

It is sometimes said that so great pains and so much apparatus are required for doing antiseptic work that the general practitioner cannot carry it out.

This is in a measure true.

The time has come when it is best for the general practitioner to have as little as possible to do with surgery.

In the country, however, where the physician must ride over long distances daily, it is very desirable that the art of applying the permanent dressing be learned.

When this is accomplished the physician will find himself so proud of his results that he will be greatly tempted to give up his general practice.

The test of one's ability to do antiseptic surgery lies in the success which attends the application of the permanent dressing.

Just as many must fail to comprehend Herbert Spencer's definition of "life," so must

many fail to grasp the intention of antisepsis.

A good old family practitioner of my acquaintance, who recently put up a fracture of the olecranon process in a right-angled position with plaster of Paris, was quite sure that antiseptic methods were not practical.

I know a prosperous merchant who hangs his barometer out of the window so that pressure variations can have easy access to it; but this does not reflect upon his ability to lead a bull movement in the corn market.

I am acquainted with surgeons who treat amputation wounds by the open method, and who would generally have to amputate in a gun-shot wound of the elbow-joint in order to get a good open wound; but this does not reflect upon their ability to treat typhoid fever well.

The merchant could easily learn something about atmospheric pressure.

The medical men could with comparatively little trouble learn to save several weeks of healing process after limb amputations, and they would seldom think of amputating in

case of compound fracture at the elbow-joint so long as circulation of blood continued in the hand.

As far as the open treatment of wounds is concerned, the method is as far behind the times in surgery as the flint-lock gun is in warfare.

After well-meant attempts at antiseptic work some men will still fail to gain expected results.

This is because they do not do antiseptic work.

The man who jumps over a brook and lands well on the bank is satisfied with the result of his effort.

The man who jumps almost across, but not quite, is in a very different mood.

There is a considerable difference between jumping entirely over a brook, and jumping almost over it.

The one who falls short will make the most noise.

Let him who can shoot ruffed grouse be the first to describe the bad qualities of red Irish setters.

Let him who can apply a plaster of Paris jacket properly be the first to say that Sayre's way of handling spondylitis is not the best way.

Let him who can apply a permanent dressing to a compound fracture at the ankle-joint be the first to decry antiseptic surgery.

CHAPTER II.

From the infinite variety of apparatus and materials which belong to antiseptic surgery, I shall select for description enough to enable the reader to do thoroughly good work in private practice.

In order to prevent confusion, I purposely avoid even the mention of much more that is equally useful, and prefer to make no reference to the elaborate apparatus which we employ in the hospitals.

THE IRRIGATOR.

Buy at the druggist's a fountain syringe of four quarts' capacity.

Use the nozzle which will throw the strongest single stream.

Hang the irrigator on something near the operating table and three or four feet higher than the top of the latter.

Pour in the antiseptic solution which you

are going to use, a few minutes before beginning an operation.

Give the whole care of the apparatus to one assistant, and instruct him to keep the wound

The Irrigator.

and the skin in its vicinity almost constantly wet while you are working.

He will wash away blood easily with the little stream and will help keep the operative field in the light.

THE RUBBER SHEET.

A piece of rubber dam, or of heavier rubber stuff, is one of the most necessary parts of an outfit.

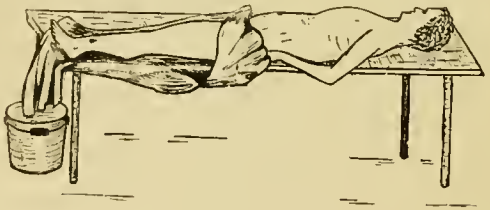
The sheet should be six feet long by three feet wide.

It is placed under the patient, or any part of him, and is gathered up when in use in such a way that fluids will run into a catch-pail below.

Clothes-pins which close with a spring are

useful for gathering up the sheet or for fastening it to blankets or clothing.

Wash the sheet thoroughly after every operation, and immerse it in 1–1,000 bichloride-of-mercury solution before drying.



Rubber Sheet, arranged for operation upon the leg.

THE RUBBER APRON.

An apron made from the same material as the sheet, and long enough to reach from the neck to the feet of the operator, is required for keeping the clothes dry and clean.

The apron should be washed after every operation.

THE OPERATING-TABLE.

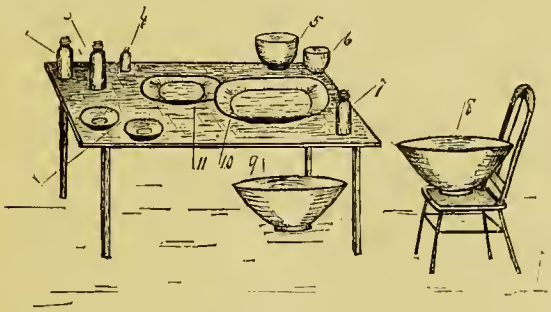
In almost any house in the civilized world a table which is suitable for operative purposes may be found.

It should be so placed that a good light from a neighboring window will fall upon it.

Blocks of wood should be placed under two of the legs of the table, in order to allow irrigating fluid to gravitate toward the end or side where the catch-pail stands.

INSTRUMENT RECEPTACLES.

Place a small table and a chair near the operating-table.



ROUGH AND READY.

1. Saucers for catgut, needles, etc.
2. Bottle of Lister protective.
3. Bottle of drainage-tubes.
4. Bottle of iodoform.
5. Large bowl for rinsed sponges.
6. Small bowl for artery forceps, etc.
7. Bottle of silk-worm gut, silver wire, etc.
8. Wash-bowl for rinsing sponges.
9. Wash-bowl for preparing towels and hands.
10. Large platter for large instruments.
11. Small platter for small instruments.

On the small table put a roast-beef platter for large instruments; a large bowl for clean sponges; a small platter for small instruments, and two or three saucers for catgut, needles, etc.

On the chair place the large wash-bowl, in which sponges are to be rinsed out.

Fill the instrument platters with an 1–30 solution of carbolic acid.

Fill the saucers for catgut with the alcohol in which the catgut has been stored.

Fill the wash-bowl with an 1–2,000 solution of bichloride of mercury.

THE RAZOR AND BRUSH.

For cleaning the skin before an operation, a sharp, narrow-bladed razor and a nail-brush are necessary.

Rub a wet piece of soap over the surface of the skin, and shave carefully, no matter whether any visible hairs exist or not.

Scrub off the soap with the nail-brush, and rinse with an 1–1,000 bichloride solution at the same time.

BICHLORIDE-OF-MERCURY SOLUTION.

Fill an eight-ounce bottle with hot water.

Add sixteen grains of powdered bichloride of mercury to each ounce of water.

Take this bottle along in your valise when going out to operate.

One ounce of this solution to the quart of water will make approximately an 1–1,000 solution.

Bichloride solution, of the strength of 1–1,000, will kill microbes in a few moments, and is not harmful to the patient, if used in the right way.

If a large quantity be left enclosed in a wound, or in an uterus after an intra-uterine douche, trouble is likely to follow.

Dry the wound with a moist sponge—to use a Hibernianism,—or wash away the strong solution with a final dash of 1–5,000 solution.

As a matter of fact, it is seldom necessary to use the 1–1,000 solution about a recent wound.

It is used principally for cleaning the surface of the skin in the vicinity of the wound, for cleaning the surgeon's hands before beginning

an operation, and for washing out the interstices of a wound which is not sweet.

For a long while I used the 1–1,000 solution exclusively for irrigating, and for general antiseptic purposes, and had no resulting trouble.

Finally I poisoned a patient with it.

After amputating at the middle of the thigh, I allowed a considerable quantity of the strong bichloride solution to remain in the wound when the latter was closed.

A few hours afterward the patient began to complain of intense pain along the region of the descending colon.

This pain continued for about a week.

The patient was obstinately constipated.

The pulse was continually rapid and not strong.

The temperature was slightly elevated.

He suffered from constant nausea.

He was salivated.

The operation in itself had caused little constitutional disturbance, as the man was clear-headed and preferred to sit propped up in bed so soon as the effects of the ether had passed away.

There was no inflammatory reaction in the wound.

By the tenth day after the operation all of the distressing symptoms were rapidly on the wane.

On the twelfth day the dressings were changed for the first time.

A wager had been made before the operation that the tissues would be completely united by primary union on this day.

The tissues were not completely united by primary union.

They were practically not united at all.

There was no sign of inflammation about the wound, and it looked very much as it did a few moments after the operation.

The wound began to granulate finely so soon as the symptoms of poisoning had disappeared, and it healed readily by granulation.

It is an interesting fact that the bone drainage-tubes and the catgut sutures had been absorbed completely in the usual way at the time when the first dressing was removed, notwithstanding the unchanged condition of the tissues about the wound.

I would poison every such patient in this

way rather than expose him to the dangers which hover about a wound which has not been treated antiseptically.

I shall never again poison such a patient with bichloride of mercury.

I shall continue to use bichloride of mercury.

If an 1–2,000 bichloride solution is employed for irrigating purposes, etc., and if the solution be not left in a wound in large quantities, the danger from bichloride poisoning must be a very far removed one.

An 1–5,000 bichloride solution is the best one to use for washing out the peritoneal cavity, and for washing large synovial cavities and the interior of the uterus.

It is often advisable to use a strong solution for a few minutes, and then to give a final washing with the solution 1–5,000.

In the great majority of cases the best all-around solution is the 1–2,000 one.

CARBOLIC ACID.

For all carbolic-acid purposes an 1–30 watery solution is sufficient.

The instruments in the dishes are covered

with this solution before being used at an operation, and they are placed back in it when not in use during the operation.

Bichloride of mercury in solution should not be used in the presence of metals.

A precipitate forms rapidly.

The jars and bottles in which are stored sponges, sheet lead, Lister protective, silk, rubber drainage-tubes, etc., should be filled with the carbolic-acid solution.

IODOFORM.

Iodoform is an exceedingly useful accessory antiseptic substance.

It is dusted over the surface of a wound which is to remain open, or along the line of suture, and about the mouths of the drainage-tubes in a closed wound.

The numerous other occasions for the use of iodoform will suggest themselves to the surgeon so soon as he appreciates the fact that serous and other discharges *must* remain sweet when they are impregnated with a sufficient quantity of this drug.

If a large amount of iodoform (four to eight

drachms) be used on an open wound, toxic effects, marked by continued mild delirium, a rapid and feeble pulse, and a remittent temperature running up to 102° Fahr., may supervene.

I have used the drug constantly in varied surgical work and have seen two cases of poisoning. Both of these were extensive burn cases, and I used about an ounce at a time on the exposed surfaces.

In cases of poisoning by iodoform the symptoms usually disappear rapidly if the unabsorbed portion be removed.

There is no danger connected with the use of iodoform, provided that the surgeon be aware of the fact that there is danger connected with the use of iodoform.

The drug may be compared with whiskey in the above respect.

The amount of iodoform which is required for covering an ordinary wound falls far short of being a dangerous quantity.

LISTER'S PROTECTIVE OILED SILK.

This is smooth and unirritating. A strip which is wide enough to cover the sutures should be used on a closed wound.

Tear holes in the protective opposite the mouths of the drainge-tubes so that serum may easily percolate through the neighboring gauze.

A piece which is a little larger than any given open wound should be placed upon the wound; so that epithelium cells which are working their way across the granulations will not become entangled and discouraged in the gauze or cotton.

We can all remember the barbarous days when dressings stuck to wounds and when it hurt the patient to change dressings.

The protective, to be ready for use, should be torn into strips and put into large-mouthed bottles which are filled with the carbolic-acid solution.

GUTTA-PERCHA TISSUE.

A very thin and flexible waterproof material possessing a wide range of usefulness.

The dressing on a small wound will sometimes dry too quickly, and allow the adhering of cutaneous margins by an other than pathological process, before the discharge of serum from the deeper tissues has stopped.

Serum dammed up in the wound presents a mechanical obstacle to repair ; as organization of the plastic lymph is obviously thus interfered with.

Cover small dressings with gutta-percha tissue and they will not become too dry.

Very moist dressings are as much to be avoided as very dry ones, and if the dressing have become soaked with serum, it is best to change it for a fresh one.

It will seldom be necessary to make more than one such change in any one case.

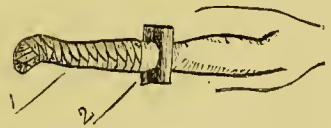
In operations about the head, in which the irrigating solutions and blood may run into the eyes or through the hair of the patient, a wide strip of gutta-percha tissue can be fastened by one margin to the skin of the forehead in such a way that the remainder of the piece will fall over the parts to be protected.

For preventing rapid evaporation from the skin, and for purposes of general neatness in abdominal operations, a large sheet of the gutta-percha tissue is fastened to the abdomen.

A sufficiently large hole is cut in the centre of the piece before applying, and the margins

of the opening then surround the operative field.

When an injured limb is to be elevated, and permanent irrigation employed, the gutta-percha tissue is invaluable ; a piece being fastened about the limb in such a way that water is prevented from running down along the limb toward the body.



1. Loosely bandaged gauze dressing. 2. Gutta-percha tissue.

The tissue is best fastened to the skin according to the method of Dr. Woodward, which is as follows :

As much gutta-percha tissue as will dissolve in chloroform is put into a small bottle full of that liquid.

The mixture is ready for use in a few minutes. A camel's-hair brush is wanted.

Draw the brush full of the solution quickly along that part of the skin where the margin of gutta-percha tissue is to be attached.

Apply the margin which is to be attached.

Wait a moment for softening to take place, and then put fresh, narrow strips of the tissue along the soft and sticky edge.

Don't draw the brush over the gutta-percha tissue unless you want to get into an armful-of-oars predicament.

Tissue which is to be used in the vicinity of a fresh wound must be washed in bichloride solution before being applied.

DRAINS.

Serum or blood when locked up in a wound delays repair.

Drainage-tubes made from decalcified bone are inserted into a wound in such a way that serum and blood may escape.

The tubes collapse in a few hours after insertion. They are usually completely absorbed by the tenth day, and the opening left in the tissues is usually closed by the fourteenth day.

Cases have been reported in which a much longer time was required for absorption of the bone tubes. I am inclined to believe that inflammatory processes were allowed to go on in

the wounds in which these tubes have remained unabsorbed.

It is best to put a disinfected safety-pin through the projecting end of the tube, in order to prevent it from slipping in under the skin.

Keep the bone drainage-tubes stored in alcohol.

Rubber drainage-tubes must be used where pressure of surrounding tissues would collapse the bone drains too quickly.

Some surgeons employ rubber drains exclusively. The tubes of this material have one objection :

They must be removed after their period of usefulness in a wound has passed.

The dressing must be changed in order to remove the tubes.

I do not like to change a dressing until the wound has healed.

Before inserting a rubber tube, bend it sharply at the junctions of its half inches, and cut off the resulting angles with a pair of disinfected scissors.

Tubes of proper size and shape are thus

made. After insertion into a wound, the tubing which projects above the skin should be cut off and a disinfected safety-pin stuck through the end which lies at the surface.

A tube which I inserted into the wound, after doing an operation for the radical cure of bubo, was not supported by a safety-pin.

The tube disappeared beneath the skin.

The wound healed over the tube, and I was obliged to cut it out later.

Keep the rubber drainage-tubes in bottles of 1–30 carbolic-acid solution until they are ready for use.

Catgut drains are desirable for small wounds.

Serum will find its way along a single strand of catgut, just as urine finds its way along a filiform bougie.

Any number of strands of catgut may be bunched together in order to make the drain larger or smaller.

Soak the strands in 1–2,000 bichloride solution for fifteen minutes before using them for drainage purposes.

Catgut swells rapidly in watery fluids.

If it be taken out of alcohol and used di-

rectly as a drainage-conducer, the swelling strands will close the gates against departing serum.

SILK.

Silk has had its day.

Surgeons who work antiseptically still employ it occasionally for special suturing and ligating.

I use it for sutures about the eye, because a more delicate strand can be made from it than from catgut; and for ligating hæmorrhoids, because such great strength is required in order to properly cut off the connection between the pile and the rest of the patient.

Silk should be kept in a bottle of 1–30 carbolic-acid solution.

Keep only a small amount ready for use, because it loses its strength after standing for several weeks in the solution, and a fresh preparation will be required from time to time.

CATGUT.

For general suturing and ligating purposes ordinary catgut should be used.

Sizes 8, 7, and 5 are most often required, in their respective order, number 8 being the smallest of the three.

Raw catgut is prepared antiseptically as follows :

Put the skeins in a bottle full of oil of juniper, and let them stay there for two or three days.

The oil of juniper dissolves out the fixed oil of the gut.

Empty out the oil and rinse the skeins with alcohol.

The alcohol dissolves all oil.

Put the skeins in a wide-mouthed bottle filled with commercial alcohol, and keep them in the alcohol until wanted for use.

Be sure and tie catgut ligatures with a square knot.

Hold the knuckles of your thumbs together when tying so as not to throw artery forceps out of the window when the gut breaks.

If the knot is to be subjected to considerable tension, a double square knot is required.

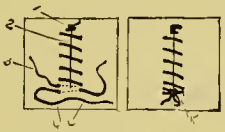
Don't cut the free ends of gut too close to the knot.

For fastening the free end of gut after taking the last stitch in a continued suture I would suggest the following method:

Leave two inches of free end when you cut off the surplus part of the strand.

Run the needle and surplus part of the strand once more through the skin in the usual *interrupted* suture way.

Tie the *interrupted* suture with a square knot.



KNOTS FOR HOLDING CATGUT ENDS, IN A CONTINUED SUTURE.

1. Firmly tied ordinary slipknot.
2. Line of incision in skin.
3. Free end of continued suture.
4. 4 Free ends of interrupted suture.
5. All knots tied.

Tie one of the free ends of the *interrupted* suture gut in a square knot with the free end of the continued suture gut.

Catgut is usually completely absorbed by the end of the tenth day after its introduction into the tissues.

The smallest size sometimes disappears during the first week.

A delicate variety of catgut, put up in carbolized oil, is found in the drug stores, and this sort will sometimes be wanted for suturing intestine or nerves, or for face work. It is altogether too expensive for general use.

CHROMIC CATGUT.

Sometimes a durable form of catgut is required.

If it be prepared with chromic acid it does not begin to disappear before the fourteenth day.

The process of preparation is a rather complicated one (see "Antiseptic Surgery," by W. Watson Cheyne, M.B., F.R.C.S. London: Smith, Elder, & Co., 15 Waterloo Place. 1882. Pp. 57 and 58), and consequently it will be best to buy ready for use what little is needed.

SILK-WORM-GUT.

The unspun fluid of the silk-worm, which would have been silk if spun, has been long used by fishermen for making leaders and snells.

It is strong, smooth, unirritating to the tissues, and is never absorbed.

Silk-worm-gut is stronger than silver wire of the same thickness, and is very flexible.

Surgeons have recently been using it for a variety of purposes.

I am especially fond of using it for supporting tissues which would otherwise strain too heavily on the catgut sutures.

For instance, after amputation of a large female breast, the catgut sutures are subjected to a disturbing degree of tension.

This can be obviated in the following way: Thread a large needle with one strand of silk-worm-gut.

Pass the gut transversely across the wound, and so deeply that each end of the strand will emerge from the skin at a point situated a couple of inches from the margin of the wound on its corresponding side.

Thread the needle with successive threads, and repeat the process until enough have been inserted into the flaps to hold the latter in fairly close apposition.

Don't fasten the ends until later.

Usually four or five such sutures are needed.

This is the first step in the operation of closing the wound.

The next step would be the suturing of the flaps with catgut and the insertion of drainage-tubes.

The last step consists in fastening the silk-worm-gut sutures.

They have lain loosely in the tissues while the other work was being done.

A couple of inch-and-a-half wide strips of sheet-lead are now taken from the dish of carbolic-acid solution.

Each one is about half as long as the wound, and is perforated with a row of small holes running along its middle.

The ends of silk-worm-gut which project from one of the flaps are passed through holes in the strip of lead.

A perforated B.B. shot is slipped over each end of silk-worm-gut on that side, and is mashed on the gut with a pair of strong forceps.

Twitch each of the free ends of silk-worm-gut on the opposite flap to see if the shot are going to hold.

An assistant next holds both flaps so firmly together that the catgut sutured part is loose and lax.

The other strip of sheet lead and the shot are passed over the remaining free ends of silk-worm gut.

The shot are pinched hard.

The assistant removes his hands.

The strain comes on the broad lead plates, and the line of catgut sutures is relieved of much responsibility.

Change the dressings for the first time at the end of the second week.

Remove the lead strips and the silk-worm gut.

The catgut and drainage-tubes will have disappeared by absorption.

The old-fashioned method of supporting tissues with plasters, and which was devoid of mechanical tone, may be done away with in its entirety.

There is no excuse for the use of plaster about wounds of any kind at the present day.

Silk-worm-gut will in many cases take the place of silver wire for fastening together the fragments of bone in a compound fracture.

It will perhaps be necessary here to twist three or four strands together.

Tie the gut in a firm square knot and cut the ends off as closely as you please.

The knot will not slip easily.

Silk-worm-gut would seem to be desirable as a suturing material in Bank's hernia operation. If the fibrous margins of the abdominal wound are brought into apposition by means of sutures of the material in question, placed one third of an inch apart, the margins must stay in position until sufficient plastic lymph has been thrown out for the purpose of repair.

The ends of the silk-worm-gut are cut close to the knot.

The sutures remain indefinitely.

The previously necessary pad, the pressure of which caused more or less absorption of the plastic deposits, may be done away with.

The cutaneous wound closed with catgut sutures should heal with great regularity by primary union.

Silk-worm-gut should be kept ready for use in a bottle of 1–30 carbolic acid-solution.

It is soft and flexible when first removed

from a watery fluid, but becomes too hard for use in a few moments if allowed to dry.

LEAD STRIPS AND SHOT.

The strips of lead previously referred to may be whittled out of sheet-lead with a jack-knife.

Bore the holes in these and in the shot with an ordinary awl.

Scrape rough edges which would irritate the skin.

Put the strips and the shot in the carbolic-acid solution along with the instruments before beginning an operation.

Cut the strips into any desired length as occasion requires.

SPONGES.

For ordinary surgeon's purposes use selected reef sponges.

Buy them by the pound.

They do not cost much, and the surgeon can throw them away after employing them once.

Prepare the sponges as follows:

To one gallon of water add eight fluid

ounces of a saturated solution of permanganate of potassium.

Put in half a pound of sponges.

To another gallon of water in another vessel add three fluid ounces of concentrated hydrochloric acid and one ounce of hyposulphite of soda.

After the sponges have remained in the permanganate solution for fifteen or twenty minutes, take them out one at a time.

Squeeze them as dry as possible.

Toss them into the acid-and-salt solution.

Add a fresh lot of the acid and salt so soon as the last thrown-in sponges fail to turn white.

Remove the bleached sponges. Squeeze them.

Put them where they will become very dry.

Hire a boy to beat out the sand. Put what sponges are wanted for use in the near future into fruit jars filled with 1–30 carbolic-acid solution.

At an operation a few of the sponges are removed from the jar, squeezed out, and thrown into the bowl of 1–2,000 bichloride-of-mercury solution.

A clean, empty bowl on the table will hold the sponges after they are rinsed and squeezed.

Flat sponges and other valuable varieties may be recleaned and used repeatedly as follows :

Wash out blood and other contents as thoroughly as possible.

Put the sponges in a vessel of water.

Set the vessel in a warm place.

As soon as decomposition has broken down the fibrin which was entangled in the sponges, they are to be washed in clean water and then put through the original bleaching process.

I use sponges only once, and have preferred to throw away a couple of dozen in the course of a week rather than run any risk which might attend a second using of any one lot.

BICHLORIDE GAUZE.

Cheese-cloth, mull, and other gauzy stuffs are deprived of all fatty material, and are then impregnated with an 1–1,000 solution of bichloride of mercury.

The process of manufacture is a complicated

one, and it is best to buy the gauze ready prepared.

Serous discharges from a wound percolate readily through this material,—especially if a handful of it be crumpled up before applying, and the contained mercuric salt going into solution in the serum prevents all fermentative processes.

On account of the large interstices in the gauze, a too rapid drying is apt to go on, and consequently a layer of bichloride cotton in large dressings, or of gutta-percha tissue in small dressings, is necessary.

BICHLORIDE COTTON.

An absorbent cotton prepared with an 1–1,000-solution of bichloride of mercury is more economical than gauze as a dressing.

The cotton does not remove discharges from the region of a wound so rapidly as the gauze removes them.

It is best to use a layer of several thicknesses of gauze in the immediate vicinity of a wound, and to cover the gauze with a thicker and larger layer of the cotton.

Buy the cotton ready prepared.

BANDAGES.

Bandages of gauze, prepared with bichloride-of-mercury solution, should be used for holding dressings in place.

TOWELS.

Dressings ought to be cut and prepared on clean towels just before an operation, and then rolled up in the towels ready for use.

An assistant, whose hands are unprepared, must touch only the outside of the towels.

Clean towels, wrung out in 1–2,000 bichloride solution, are placed about every thing near a wound, in such a way that hands, instruments, sutures, etc., cannot come in contact with any thing which is not antiseptically prepared.

The towels must be watched and kept in place.

I have seen an absorbed operator allow the silk for an abdominal ligature to trail across a leucorrhœal vulva, supposing that towels were so arranged as to prevent the silk from squirming around into any unclean place.

The patient died of septic peritonitis ; but then several drops of perspiration from the

operator's face, three or four hairs from an unshaven mons veneris, and part of the contents of an ovarian cyst, went into the abdominal cavity along with the silk ligature.

The abdominal cavity in this case was carefully cleaned after the operation with a sponge, which had fallen on the floor only once.

The operator is not convinced that antiseptic precautions offer great advantages over simple cleanliness, as he states in an article relating to the subject.

Patients go from great distances to this surgeon and allow him to start botanical gardens on their insides.

All this in connection with towels. The little digression in the last paragraphs seems to be justifiable.

WHERE MATERIALS CAN BE BOUGHT.

L. H. Keller & Co., 64 Nassau St., New York, sell raw catgut.

In lengths of one metre each :

	PRICE.
Eight dozen metres of No. 8 .	$0.75
Seven " " " 7 .	.75
Six " " " 6 .	.75
Five " " " 5 .	.75

In lengths of five metres each :

	PRICE.
One dozen lengths No. 0 (= No. 8 short) .	$0.50
" " " " 1 (" 7 ") .	.50
" " " " 2 (" 6 ") .	.85
" " " " 3 (" 5 ") .	1.10

McKesson & Robbins, wholesale druggists, New York, furnish sponges.

	PRICE.
Mixed reef sponges, per pound	$1.50
Assorted reef " " "	1.75

Any druggist can supply the fountain syringe, which is used as an irrigator.

	PRICE.
Capacity three or four quarts . .	$1.50 to $2.50
Powdered bichloride of mercury, Iodoform, Carbolic acid,	Varying with druggist.

Dealers in fishing tackle have silk-worm-gut on hand.

	PRICE.
In bunches of 100 strands . .	$2.00 to $3.00
Separate strands	.02 to .03

Chas. G. Am Ende, Hoboken, New Jersey, furnishes general antiseptic supplies. Here are a few quotations from his list :

	PRICE.
Rubber dam. Three feet by six	$3.00 to $3.50
Rubber cloth, 1½ yard wide, per yard .	2.00
Gutta-percha tissue, per yard . .	.35
Bone drainage-tubes. No. 1, smallest, to No. 4, largest, per dozen	3.50
Rubber drainage-tubes. No. 1, smallest, per y'd	.50
" " " " 2 " .	.60
" " " " 3, most used " .	.70
" " " " 4 " .	.80
Bichloride of mercury gauze; absorbent, " .	.15
Five-yard tins, per dozen	9.00
Bichloride of mercury cotton; absorbent, per pound	1.25
Bichloride of mercury gauze bandages, per doz.:	
5 yards by 1 inch	.50
5 " 1½ inches	.60
5 " 2 "	.70
5 " 2½ "	.80
5 " 3 "	.90
5 " 4 "	1.00

Chromic catgut, and delicate prepared catgut of other varieties, at special prices.

CHAPTER III.

When a wound has been made the surgeon is called upon to recognize the presence of:

First. Injured tissues which nature will repair to a greater or lesser extent.

Second. Effused fluids which will conduct repair.

Third. Parasites which live at the expense of the wound fluids.

The surgeon's first duty is to remove obstacles to repair.

Obstacles to repair are principally mechanical and chemical.

Mechanical: as when lint, salve, fragments of bone, etc., remain in contact with raw surfaces; or when loss of tissue prevents adaptation of parts.

Chemical: when microbes grow in the discharges and cause fermentation.

The latter obstacle to repair is the more

difficult of removal, but is not at all hard to prevent if we begin in time.

If a cutting operation is to be done, or if an accidental wound is to be dressed, we must first prepare the skin by getting out of the way as many of the present microbes as possible.

General directions, then, are as follows :

Shave that part of the skin which is to be covered by an important part of the dressing.

Shave the most delicate and cleanest skin as well as the roughest and most hairy.

Scrub the shaved part with a soft brush and soap-suds in order to remove loose superficial epithelium.

Wash away the soap-suds with 1–1,000 bichloride-of-mercury solution.

Wring out light towels in 1–2,000 bichloride solution, and put them where they will protect from all unprepared objects in the vicinity ; arranging them so that instruments, catgut, fingers, etc., shall touch towels and towels only, when not employed during the operation.

Hands which are to come in contact with the

wound, or which are to touch instruments, apparatus, or dressings, must be washed and scrubbed thoroughly in 1–1,000 bichloride solution before the operation is begun.

These same hands must be rewashed whenever any unprepared object is touched during the operation.

Instruments which were made scrupulously clean after the last previous operation, are to be put into an 1–30 carbolic-acid solution for half an hour or more before being used, and they are to remain in the carbolic acid when not in use as work proceeds.

All handling of dressings, catgut, sponges, etc., must be very cautiously done, and constant watch must be kept on attendants who are liable to violate any antiseptic rule.

Dressings should be prepared on clean towels before the commencing of an operation.

During the open-wound part of an operation the irrigating solution should be frequently squirted over the region of work—dampening the skin, the exposed deep tissues, the hands of the operator, and the ardor of the microbes which are settling on forbidden ground.

When a wound is being closed, drainage must be provided for by means of strands of catgut, absorbable bone drains, rubber tubing, or any other suitable means for the end.

After the wound has been closed, iodoform should be sprinkled along the line of sutures and over the ends of the drains, for the purpose of fortifying the position strongly against fermentation.

Prepared Lister protective (Chapter II.) should then be placed over the line of sutures, to prevent any irritation from the other parts of the dressing, and to prevent the adhering of any part of the dressing to the region of the wound or to the sutures.

A handful of mussed-up bichloride gauze must be placed loosely about the wound, to allow of easy percolation of serum.

Enough more bichloride gauze or cotton to catch and retain the serum must be added.

If you don't guess closely enough on the amount of gauze and cotton required in any one case, and serum runs through to the outside of the dressing, a good sprinkling of iodo-

form must be tossed over the moist places, and more gauze or cotton added.

Don't change the dressing because serum has run through it.

The serum is so thoroughly impregnated with iodoform and bichloride of mercury that it cannot decompose.

Don't change the dressing, as a rule, until you believe the wound to be healed.

There are perhaps five indications for changing dressings before the wound has healed:

First, when rubber drainage-tubes need to be removed.

Second, when troublesome secondary hemorrhage occurs.

Third, when the operation has not been done antiseptically and high temperatures give warning of mutiny in the forecastle.

Fourth, when plastic operations or other supplementary work must be done.

Fifth, when the surgeon's curiosity is rampant and uncontrollable.

Concerning case first: the dressing must be removed under irrigation and with disinfected

hands; the new dressing being as carefully prepared as the first.

This having been done the second dressing may remain undisturbed for weeks if necessary.

In regard to case second, secondary hemorrhage is one of the rarest of wound complications if the operations have been antiseptically managed.

If a large artery be ligated at a point near any of its branches, or if the ligature be loosely tied, or if small arteries be overlooked because a weakened heart fails to force blood through their contracting mouths, then of course secondary hemorrhage may be expected.

The old-fashioned and much dreaded hemorrhages of pus days are not at present admitted into cultivated surgical circles.

The third case of necessity for a change of dressing,—a septic condition of the wound,—would cause a good deal of criticism among the surgeons who hold modern views.

However, it is perhaps necessary to put uncertain operators on their guard against allowing mischief of serious character to follow a septic accident.

If on the day after an operation the patient's temperature should arise to 102° F., with a full and hard pulse accompaniment, a saline cathartic and aconite must be given.

This temperature will not infrequently follow an operation which causes much constitutional disturbance, and it will remain for a few hours. If the temperature reach 102° F. on the second day after an operation, it would be advisable to change the dressing and examine the wound, unless an evident outside cause for the temperature existed.

If at any time during the course of wound repair the temperature should reach 102° F. on two successive days, a careful examination for the cause of such temperature should be made.

Open treatment would probably be called for if marked inflammation about the wound were found to exist.

A very little experience in antiseptic surgery will teach the operator how to avoid having such a case.

The fourth cause for change of dressing needs no comment at present.

As to the fifth cause, we notice that it is almost impossible for men who are just beginning to do good surgery to leave dressings alone.

They are so accustomed to a different order of things that a great deal of moral courage is required for holding in abeyance the Borean blasts of curiosity which clamor for release.

In scientific antiseptic surgery the mechanical obstacles to repair must be handled in a radical way. Tissue which is likely to slough should be trimmed away before closing a wound. Sloughs of small size will be rapidly absorbed but large ones may excite suppuration.

All bleeding from the small vessels in a wound should be effectually attended to, even if much time is required for doing it.

The small clots as well as the large ones should be removed before a wound is closed.

The wound must be so shaped if possible that like tissues may be coapted.

The coapting sutures must, as foreign bodies, be so arranged as to be undisturbing.

Serum and late oozing blood must find easy departure from the recesses of the wound.

Motion in wounded tissues delays or prevents repair, and must be guarded against; tender new growth needing protection in animal as well as in vegetable tissues.

Most of the obstacles to repair excite inflammatory processes in the wound if they are not prevented from doing so by the surgeon.

When I speak of inflammation I do not mean to include the hyperæmia of repair.

Inflammation and the hyperæmia of repair allow of differentiation.

With the former we have swelling, pain, and abnormal heat and redness.

With the latter we do not have swelling, pain, and abnormal heat and redness.

There may be an insensible gradation between the two conditions, just as we find an insensible color gradation in man between the African and the Anglo-Saxon races.

Negroes are not often mistaken for Scandinavians.

Inflammation should not be mistaken for the hyperæmia of repair.

A wound may be defined as a limited interruption in the continuity of the tissues of any

living organism, caused suddenly by violence acting through any instrument or agent.

This definition will include such burns as are essentially wounds but which have usually been excluded from classification among the wounds.

Wounds as best classified are incised, lacerated, contused, punctured, poisoned, or burned.

Under each class I shall describe an artificial series of varieties.

A description of the treatment for a few types in wounds will serve for giving an idea of the course which would be followed in analogous cases.

Class 1, Incised Wound. Variety 1, A Recent Wound.

A butcher has received a cleaver-cut across the front of the wrist.

He comes to you an hour or two later with a handkerchief tied tightly about the wound.

A casual examination shows that the cut has extended into the carpal joint, and that the styloid process of the radius is split off.

The patient does not wish to take ether, but his wishes are to be ignored.

Have a couple of assistants at hand. Prepare instruments and apparatus.

Get the following things ready :

The rubber sheet.

The irrigator filled with 1–2,000 bichloride-of-mercury solution.

A large dish filled with 1–2,000 bichloride solution for washing sponges.

A dish filled with 1–1,000 bichloride solution for washing the clotted blood, etc., from the patient's wrist, for cleansing the hands of operator and assistants, and for moistening towels.

A dish filled with 1–30 carbolic-acid solution for scalpels, artery-forceps, retractors, scissors, needle-holder, etc.

A wide-mouthed bottle filled with No. 8 and No. 7 catgut in alcohol.

A small bottle of chromic catgut.

A wide-mouthed bottle full of Lister protective in 1–30 carbolic-acid solution.

Iodoform.

Bichloride gauze.

Bichloride cotton.

A skein of catgut in a saucer of 1–2,000 bichloride solution.

Two or three bichloride-gauze bandages.

A razor and nail-brush.

Soap.

Prepared sponges.

Apply Esmarch's bandage or the tourniquet to the patient's arm.

Lay the hand and wrist on a part of the rubber sheet, and arrange the latter so that it will allow irrigating fluids, etc., to run into the catch-pail.

Wash away blood-clots, etc., with 1–1,000 bichloride solution.

Wash the skin in the vicinity of the wound with soap-suds, and shave the surface for a distance of several inches above and below the wound.

Wash off the soap-suds with 1–1,000 bichloride solution.

Wring out a towel in 1–1,000 bichloride solution, and spread it on the rubber sheet under the hand and injured wrist.

Place another towel of the same sort on the arm above the wrist.

Put another prepared towel where it will catch instruments, catgut, etc., which are laid aside now and then during the operation.

Scrub your hands in the 1–1,000 bichloride solution.

Ask an assistant to begin irrigation with the 1–2,000 bichloride solution, and to continue the irrigation at intervals while work proceeds.

If you take the irrigator-tube in your hand at any time during the operation, don't forget to dip this hand in 1–1,000 bichloride solution before again touching the wound.

If a sponge fall on the floor, let it stay there.

Don't pick it up; and allow no one to touch it.

It might accidentally get back into the region of the wound again.

The regularity with which such sponges usually return to the wound is only exceeded by the regularity with which some operators give the wound a final dab with the cleaning-up towel.

If an instrument be laid on the bare table, or if it touch any unprepared object, in fact, that instrument must go back into the carbolic-acid solution before being employed again.

If an assistant in handing you a piece of catgut allow the catgut to touch his coat-

sleeve, the strand must be put back into the alcohol and a new one substituted.

On making an examination of the wound, the following condition of things is found to exist :

The cleaver has incised the skin cleanly, and has severed the tendons of the palmaris longus, flexor carpi radialis, extensor ossis metacarpi pollicis, extensor primi internodii pollicis, flexor sublimis digitorum, flexor profundus digitorum, and flexor longus pollicis muscles.

The cut ends of the tendons have retracted, and the sheaths are open.

The median nerve and the radial vessels have also been cut in two.

The radial styloid process is separated from the radius.

The joint is found to be widely opened.

According to old views, this wound would be a dangerous one.

Treated according to modern views, this wound will give the surgeon no anxiety and will cause the patient almost no pain.

In wounds of this character inflammation and suppuration can be prevented with mathematical certainty.

Pull the margins of the wound far apart with retractors.

Wash the exposed portions of the synovial cavity with the irrigating solution.

Fasten the separated styloid process in place with a bit of chromic catgut passed through the periosteal margins, or through little holes drilled for the purpose.

Approximate the fragments closely, in order to insure primary union between them.

Find next the median nerve.

If the ends have retracted until they are out of sight, cut for them.

Cut until you find them.

When the ends are found, they are to be sutured together with one or more delicate strands of catgut.

Hunt for the ends of the divided tendons. If they have retracted until they are out of reach, cut until they are within reach.

If an end of palmaris longus tendon be sutured to an end of median nerve, there is great danger of the sutures becoming absorbed before the nerve has learned to pull on the palmar fascia.,

Suture tendons in their respective continuities, that functional proprieties be not shocked.

Tie the catgut with a firm, square knot, and then tie another knot of the same kind on top of it, when suturing the tendons.

It is not necessary here to suture the cut margins of synovial membrane.

Ligate the cut ends of the radial artery with No. 7 catgut.

Remove the tourniquet.

Ligate smaller bleeding vessels with No. 8 catgut.

Wait until all oozing of blood has stopped. Take the skein of swollen catgut out of its saucer of bichloride solution.

Cut seven or eight short strands from it.

Bind the strands loosely together with one of their number.

Put one end of the bunch as deeply in the wound as it will go.

Allow the other end of the bunch to project externally.

This little bunch of catgut will act very thoroughly as a drain and will cause no disturbance.

Fasten skin margins together with interrupted catgut sutures.

Don't let an edge of skin turn under when the sutures are tightened, and avoid a too close suturing in the vicinity of the drain.

Sprinkle iodoform along the line of suture.

Take an inch-wide strip of Lister protective out of the antiseptic solution in which it has been stored and lay it over the wound, tearing a hole in it opposite the drain.

Muss up a handful of bichloride gauze and place it loosely about the wrist.

Flex the hand strongly, and apply a bandage of bichloride gauze in such a way that it will remain flexed.

Wrap a big wad of bichloride cotton about the hand and wrist and lower half of the arm.

Tell the patient to carry his arm in a sling until the dressing is changed.

Change the dressing for the first time after three weeks have elapsed.

Suppuration will not occur in this wound; when the dressings are removed, the gauze in the vicinity of the wound will be discolored and slightly moist.

A drachm of transparent gelatinous discharge will be found adhering to the protective. The dressing will smell as sweet as new bread.

No trace of the catgut sutures or drain can be found.

Begin passive motion gradually, and continue it vigorously.

Apply the galvanic current to the muscles of the hand which receive nerve supply from the median nerve.

Continue treatment until enough improvement has been gained.

CLASS 1, Incised Wound; Variety 2, An Inflamed Wound.

A patient who has received the same injury as that described under Variety 1, comes to you three days after the accident.

When the wrist was cut the man called on "the nearest doctor," who treated the case as follows :

The wrist was washed off under the warm water faucet.

The cut ends of the radial artery were ligated with ordinary surgeon's silk from a

skein which was fished up from the depths of the dressing-case.

The artery-forceps which were used "looked pretty clean."

Half a dozen sutures from the skein which furnished leaven for the radial artery hold the skin margins together.

The local newspaper correspondent said that Ebenezer Crain cut himself so badly that Doctor Smith was obliged to put six stitches in the wound.

Sheet lint on which vaseline was spread covered the wound, and the patient was advised to keep this dressing moist with carbolic-acid solution,—signa: teaspoonful in a pint of water; use as directed,—and to return on the next day.

The patient kept the dressing wet fairly well during the first day, but at night it was not convenient to wake up every few minutes and attend to it.

The skin wound united.

The dressing dried so that serum could not escape.

The menagerie began to increase rapidly by young born in confinement.

Inflammation set in.

The doctor coincides with the patient in the belief that the wound healed too quickly.

The wrist is hot, swollen, red, and very painful, and there is marked tenderness along the sheaths of the tendons.

The patient's temperature is elevated; his pulse is full and hard, and he is in a condition of general unrest.

On cutting away the sutures and separating the margins of the wound, a quantity of grumous discharge escapes.

A drop of this discharge will, under the microscope, be found to be swarming with multitudes of microbes of different species.

Open treatment from the first would have been better than such closed treatment.

With open treatment the patient would only have lost the use of the tendons and of the median nerve, and of the carpal joint, and of four fifths of the hand, and the wound would not have required more than two months for cicatrization to be completed.

With closed septic treatment, however, a dangerous inflammation is thrust upon the patient.

Make a free opening into the carpus on its dorsal side.

Flush the old wound and the new one with 1–1,000 bichloride-of-mercury solution.

Wash out the joint by throwing a stream of the 1–1,000 bichloride irrigating solution forcibly into it, twisting and bending the carpus rapidly while this is being done.

Wash so thoroughly in this way that the returning fluid is perfectly clear. Spend ten minutes in doing the washing.

Slit up the openings of the synovial sheaths of the tendons and squirt them repeatedly full of the irrigating solution.

Remove the fractured styloid process of the radius. The chances of necrosis and delayed repair do not warrant us in leaving it.

Sprinkle iodoform on all reachable parts of the wounds.

Wrap eight thicknesses of bichloride gauze about the hand and wrist and lower part of the arm.

Fasten the gauze in place with a loosely applied gauze bandage.

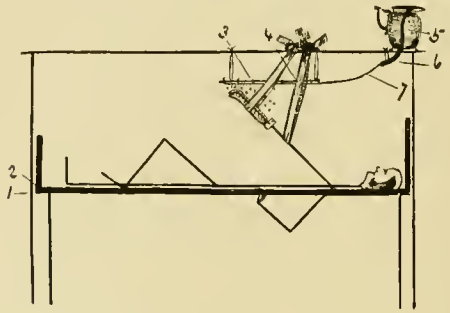
Put the patient in bed.

Tell him that he must stay in bed for about ten days.

Give him a saline cathartic.

Lessen arterial tension with aconite.

Give refreshing drinks and light diet.



THE PERMANENT IRRIGATOR AT WORK.

1. Perpendicular slat.
2. Bed.
3. Small stick with drip-rope attached.
4. Bandages for suspending arm.
5. Pitcher for antiseptic solution.
6. Rubber tubing acting as siphon.
7. Drip-rope.

Arrange a permanent irrigating apparatus as follows :

Fasten a strong upright slat to each end of the bed.

Another slat should extend between the tops of the two upright ones.

Suspend the whole arm by means of loops of broad bandage from the overhead slat.

Hang a pitcher on one of the upright slats.

Don't substitute a metallic pail for the pitcher, because a precipitate will be at once thrown down from the bichloride solution.

Fill the pitcher with 1–5,000 bichloride-of-mercury solution.

Hang a couple of feet of drainage tubing over the edge of the pitcher in such a way that it will act as a siphon, and draw away the antiseptic solution in a small, steady stream.

Suspend over the wrist a small improvised rope of cotton twine in such a way that the stream will run along it.

Turn down ends of the twine at distances of an inch apart, so that the solution will drip constantly from these ends.

Prevent the water from running down toward the patient's body along the arm by fastening a piece of gutta-percha tissue around the arm below the elbow (Chapter II.).

Arrange any rubber sheet on the bed under the arm to catch drippings, and lead them into a pail.

Don't allow the pitcher of antiseptic solution to run dry.

In eight or ten days, or, rather, so soon as you feel confident that inflammation has ceased and that the wound is granulating well, the permanent irrigating apparatus is to be removed.

The wound must heal by granulation, and consequently the suturing of the median nerve and the ends of the cut tendons will not promise much.

It is best, however, to suture the structures in question, because it is possible to get restoration of function in the nerve, and the tendons will act in opposing the extensors of the fingers and wrist, even if they do not assert their individuality.

Even if the median nerve fails to recuperate, the ulnar will pursue the even tenor of its way, and will continue to supply the muscles of the little finger, the interossei, the two inner lumbricales, the adductor pollicis, and the inner head of the flexor brevis pollicis, so that a very much better than an artificial hand will be left.

The tendons and the median nerve are to be sutured. Do not suture the skin wounds.

Do the work with all of the scientific antiseptic precautions which were described under Variety 1, and do it in the same way as though the wound were a recent one.

Dress the wound as Variety 1 was dressed.

Do not change the dressing until three weeks have passed.

The pus corpuscles from the granulating surfaces will be so few in number that the slight amount of semi-solid discharge will not appear either macroscopically or microscopically as pus.

After-treatment will be of the same character as after-treatment in Variety 1, but a good deal more of it will probably be required, and the ultimate results will be far less satisfactory.

A considerable amount of useful hand will be left the patient in all events, and amputation of the hand or arm will have been avoided.

CLASS 1, Incised Wound; Variety 3, An Operative Wound.

A case of cystic tumor of the right ovary is to be operated upon.

The tumor weighs about twenty pounds; possesses a long pedicle; and has given rise to no serious inflammatory disturbances.

Every operator prefers his own way of managing the mechanical side of an ovariotomy, and I describe a method here for the single purpose of bringing in the antiseptic features of the operation.

The room in which the patient is to be handled should be heated to more than 80° F., so that shock from chilly intestines may be avoided.

The air of the room should be filled to saturation with moisture, for the same purpose,—surface evaporation being prevented by the measure.

The following things are required:

Rubber sheet.

Irrigator filled with 1–2,000 bichloride solution.

Wash-bowl full of 1–5,000 bichloride solution for washing sponges.

Empty bowl for washed sponges.

Ordinary and flat sponges which have been bleached and stored in 1–30 carbolic-acid solution.

Bowl of 1–1,000 bichloride solution for washing hands; for the patient's skin; and for wetting towels.

Large platter filled with 1–30 carbolic-acid solution for the large instruments and lead strips.

Smaller platter filled with 1–30 carbolic-acid solution for small instruments.

Wide-mouthed bottle of No. 7 catgut in alcohol; containing also a catgut violin string of large size for the pedicle ligature.

Small bottle of chromic catgut.

Wide-mouthed bottle of silk-worm-gut in 1–30 carbolic-acid solution.

Wide-mouthed bottle of Lister protective in carbolic-acid solution.

Iodoform.

Bichloride gauze.

Bichloride cotton.

Gutta-percha tissue.

Gutta-percha solution.

Broad bandage.

Binder and safety-pins.

Razor and brush.

Soap.

Towels.

Spread the rubber sheet on the operating table and elevate the head end of the latter.

Place the patient on the table and anæsthetize her.

Cover her limbs and chest with woollen blankets.

Shave the abdomen and the mons veneris.

Spend a couple of minutes in getting the last flake of loose epithelium out of the smallest crease in the navel.

Wash the soap from the abdomen with 1–1,000 bichloride solution, and scrub the skin with the nail-brush at the same time.

Wash a foot-square piece of gutta-percha tissue in 1–1,000 bichloride solution, and then cut a four-inch long and two-inch wide hole in the middle of it. (Thick American g.-p. t. is the best.)

Fasten this gutta-percha tissue to the abdomen with gutta-percha solution (Chap. II.), arranging the piece so that the hole will include that part of the abdominal surface where cutting is to be done.

Wring out three towels in 1–1,000 bichloride

solution and place one of them across the patient's thighs.

Tuck the upper margin of this towel under the lower margin of the gutta-percha tissue.

Lay another towel on the abdomen and chest.

Tuck the lower margin of this towel under the upper margin of the gutta-percha tissue.

Place the third towel on that part of the table where instruments will be temporarily laid while you are working.

The hands of all persons who are manually interested in the operation must be scrubbed in 1–1,000 bichloride solution.

Cut through the abdominal wall to the right of the median line.

Irrigate.

Cut at a point which is far enough to the right so that the knife will pass through rectus abdominis muscle.

A cut through muscular tissue heals much more quickly and firmly than a cut through fibrous tissue does.

Don't use the irrigator after the peritoneal cavity is opened.

When the tumor is reached the patient is to be turned over on her right side.

Don't guess that you can get along without turning the patient on her side.

Watch the next operator who works without attention to this precaution, and you will be convinced of the necessity, for giving a position advantage when at work on a tumor, the fluid contents of which are to be evacuated before the tumor is removed.

Hold the tumor firmly against the opening in the abdominal wall with vulsellum forceps.

Tell the assistants to be sure and hold fast with the forceps when an opening into the tumor is made.

Keep an eye on the assistants.

Be sure that their forceps are holding the tumor in such a way that none of the contents of the cyst can get into the abdominal cavity.

Open the cyst widely with a scalpel.

Wash out the contents of the cyst quickly with the stream from the irrigator, and dry the cyst cavity with a large sponge.

Leave the sponge in the cavity.

Close the opening with a pair of catch forceps.

Leave the forceps in place.

Separate the walls of the tumor from adhering surroundings.

Ligate the pedicle in two places, an inch apart, with the largest catgut string from your wife's favorite guitar—the string having been borrowed ten days previously and prepared in oil of juniper and alcohol.

Remove the tumor from its pedicle by cutting between the two ligatures.

Ligate the ends of the large vessels of the pedicle separately with No. 7 catgut.

Drop the pedicle back into the abdominal cavity.

Insert one hand into the abdominal cavity in such a way that intestines will be held back by the back of the hand.

The finger-tips then go into Douglas' cul de sac.

Call for the pitcher full of warm 1–5,000 bichloride solution.

Pour a quart of this solution into the hole which your hand keeps open.

Remove all blood clots and small bits of loose tissue which are floated out by the flushing.

Take out your hand.

Put it back again.

Sponge all of the fluid out of the well which the hand produces.

The sponges for this part of the work must be held by long sponge-holders.

Be sure that the sponge passes along the palmar side of your hand and into Douglas' cul de sac.

The amount of fluid which can be removed from this cul de sac after the abdominal cavity is apparently dry is surprising.

If "no great man is ever surprised," then no great man has ever tried to dry Douglas' pouch after an ovariotomy.

The operative work so far described should have taken not more than fifteen minutes for its completion.

Do not hurry in closing the abdominal wound.

The patient will not receive an appreciable amount of shock from the further required manipulations, and ten minutes spent in closing the wound will be time well spent.

Pass strands of silk-worm-gut transversely

across the wound at distances of an inch and a half apart.

Each strand passes through the tissues above peritoneum and below muscle, and emerges from the skin at points situated two or three inches from either margin of the wound.

These strands are to support the abdominal walls ; and when the proper time comes they are to be fastened as follows :

Take from the carbolic-acid solution two strips of sheet-lead, and proceed according to instructions on page 65.

Each strip is an inch or more in breadth, and is nearly as long as the wound.

Holes have been made through the long middle of the strips with an awl at distances of half an inch apart.

Apply one strip first.

Pass the emerging ends of silk-worm of one side of the wound through the corresponding holes in the lead.

Slip a perforated shot down on each gut to the lead.

Pinch the shot so that it will hold.

An assistant now presses on the sides of the abdomen and relaxes the region of the wound.

The second strip of lead is applied to the silk-worm-gut strands on the other side of the wound.

After the shot have been pinched fast, the two strips of lead should support the abdominal wall near the wound so well that no tension is exerted on the catgut sutures, all strain falling on the silk-worm-gut instead.

The proper time for applying and fastening the lead strips is after all other suturing has been completed.

The other suturing should be done as follows :

Unite the cut margins of peritoneum with a row of interrupted catgut sutures placed half an inch apart.

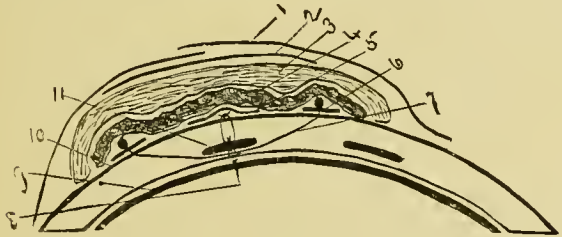
Irrigate.

Bring the muscular or fibrous margins together with a row of interrupted sutures of chromic catgut placed rather more than half an inch apart.

Be sure that each knot is a square one, and that the ends of catgut are not cut too short.

Irrigate.

Suture the skin and adipose tissues with a row of interrupted catgut sutures placed more than an inch apart, and then put in a continued suture for close approximation of skin margins.



THEORETICAL TRANSVERSE SECTION THROUGH ABDOMINAL WALL AND DRESSING.

1. Binder.
2. Gutta-percha tissue.
3. Bichloride cotton.
4. Bichloride gauze.
5. Lister protective.
6. Lead plate and shot.
7. Silk-worm-gut suture.
8. Catgut suture.
9. Peritoneum.
10. Abdominal wall.
11. Rectus muscle.

Drainage apparatus is not ordinarily required for this wound.

After tightening the silk-worm-gut sutures, iodoform is to be sprinkled over the abdominal wound and under the lead strips.

The gutta-percha tissue, towels, rubber sheet, etc., may now be removed.

A two-inch wide strip of Lister's protective is taken out of its carbolic-acid solution and laid over the line of catgut sutures.

Put a handful of mussed-up gauze over the protective and the lead.

A wad of bichloride cotton two inches thick covers the gauze.

The wad must be large enough to extend two or three inches beyond the margins of the gauze on all sides.

Cover the cotton with a foot-square piece of gutta-percha tissue, so that the dressing will remain slightly moist for a few days.

Pass a broad bandage around the abdomen.

Pin a binder snugly over all.

Remove the gutta-percha-tissue covering at the end of six or seven days.

Change the dressing for the first time at the end of two weeks.

Remove the lead strips and the silk-worm-gut.

Apply a handful of bichloride cotton and allow it to remain for a couple of days—until the little silk-worm-gut tracks have closed.

CLASS 1.—Incised Wound, Variety 4, An Operative Wound which Remains Exposed.

An internal urethrotomy for a stricture situated three inches from the meatus will perhaps furnish a good example of this variety of wound.

The bougies, sounds, and urethrotomes which are to be used must be cleaned by a person who knows what a surgical degree of cleanliness means.

The instruments should lie in an 1–30 carbolic-acid solution for at least half an hour before the operation.

A towel wrung out in 1–1,000 bichloride solution must be put where needed, for the resting of instruments while they are not in use during the operation.

The surgeon's hands and the parts of the patient's skin which will be touched must be scrubbed with 1–1,000 bichloride solution.

Half a drachm of a four-per-cent. solution of hydrochlorate of cocaine is to be injected into the urethra, ten or fifteen minutes before the operation.

The cocaine solution should be rubbed about in the urethra so that a large mucous surface will feel its influence.

If any vaseline or oil happen to be in the urethra when the cocaine is injected, the latter will of course be inert.

After cutting the stricture, the urethra, as far back as the triangular ligament, should be washed out with 1–2,000 bichloride-of-mercury solution.

The washing may be easily done by attaching a No. 9 soft catheter to the nozzle of the irrigator and then passing the catheter down to the triangular ligament.

When the stop-cock is turned, the irrigating solution will run back along the sides of the catheter and escape.

The antiseptic after-treatment of an uncomplicated case of this sort will consist simply of the injection of a couple of drachms of a solution of iodoform in sweet oil (iodoform ʒ i., sweet oil f. ʒ i.) into the urethra, after each passage of urine for the following three or four days.

Sounds to be passed before the wound has healed must be lubricated with the above iodoform solution.

If troublesome hemorrhage follow the operation it may be stopped in the following way :

Slip a six-inch long bag of thin rubber or gold-beater's skin over the end of a hard catheter.

Tie the mouth of the bag closely about the catheter with stout thread.

Dip the apparatus in the iodoform solution and pass it into the urethra.

APPARATUS FOR CONTROLLING URETHRAL HEMORRHAGE.

1. Ready for insertion into the urethra.
2. End of catheter bent and tied, to prevent escape of air after inflation of bag.

Blow through the catheter, and the bag will distend to any desired dimensions. Bend and tie the end of the catheter. Fasten the whole in place.

If one bag is not strong enough use two together.

Let out the air when the patient wants to use his urethra, and remove the apparatus.

Hemorrhage after perineal section, and nasal hemorrhage, can be managed with the same device.

If a peri-urethral abscess follow the operation of urethrotomy, there must be no indecision as to its treatment.

Go into it at once with scalpel and with antiseptic precautions.

Do not wait to see what will become of it.

We do not stand by a drill blast until it goes off in order to ascertain whether the fuse is really burning or not.

I have seen two deaths from pyæmia as a result of waiting to see whether the peri-urethral abscess would go off or not.

I have stood by the bedside of these patients while the devastating fever lighted up their faces with a lurid glow, or while their teeth chattered and clashed together, and their muscles contracted in horrible spasms, until the very windows of the room rattled; and have heard them—clear-minded—beg longingly for the relief which could not be given. Knowing, too, that had the operator understood antiseptic methods of operating, the poor fellows might have been enjoying happy days at their homes at the time when their pinched features and sunken eyes and quivering move-

ments showed that the sands of life had nearly run from their cracked and unmended glasses.

CLASS 1.—Incised Wound; Variety 5, A Wound Requiring Frequent Change of Dressing.

The operation for the radical cure of an old indolent ulcer of the leg, will bring in a wound which requires numerous changes of dressing.

Skin-grafting must be resorted to, and consequently frequent exposure of the wound will occur.

Here is the way in which an old indolent ulcer of the leg is best handled:

Anæsthetize the patient.

Shave the leg.

Wash off soap-suds with a 1–1,000 bichloride solution, and scrub with a nail-brush at the same time.

Apply Esmarch's bandage to the limb.

Cover the foot and ankle with a towel wrung out in an 1–1,000 bichloride solution.

Put another such towel around the leg above the ulcer.

Lay a third disinfected towel on the rubber sheet under the leg.

Scrub your hands in the 1–1,000 solution of bichloride of mercury.

Irrigate with 1–1,000 bichloride solution. Cut away the indurated floor and walls of the ulcer with the sharp spoon and scalpel.

Don't stop until periosteum or soft walls are reached.

Soak a small handful of bichloride gauze in balsam of Peru.

Pack the wound with this gauze. Wet a handful of bichloride gauze and place it over the other gauze.

Cover all gauze with a handful of bichloride cotton.

Put a sheet of gutta-percha tissue over the whole in order to keep the dressing moist.

Bandage lightly.

Put the patient in bed.

Elevate the leg.

Keep the patient in bed for ten days.

Keep the leg elevated for ten days.

Don't change the first dressing until ten days have passed.

Give the patient stimulating diet during the confinement in bed.

Keep on with stimulating diet after the patient is out of bed.

Allow the patient to sit up in an easy chair, but insist on continued elevation of the healing leg.

Massage and douching to the other leg will improve the circulation in both of them.

When the first dressing has been removed, the condition of the granulations will decide what steps are next to be taken.

If the granulations are not nearly up to the surface line, the former kind of dressing must be reapplied.

When the granulating surface and the cutaneous surface are nearly on a level, the treatment must be changed.

Wash the granulating surface and the skin in its vicinity with warm saturated boric-acid solution dripped from a sponge.

Don't touch the granulations with the sponge.

Reshave a portion of the skin of the leg.

From this cleaned surface cut enough pea-sized pieces of skin to make a row around the

circumference of the ulcer, when they are placed on the granulating surface, quarter of an inch from the surrounding skin margin.

Don't cut out the grafts with scissors. They are crushed by the scissor action.

Pick up a little fold of skin on the point of a sharp needle, and cut it away with a cataract-knife.

Place each little piece of skin directly where you want it on the surface of the ulcer.

Sprinkle iodoform lightly over the ulcer and its contained skin-grafts.

Take a piece of Lister protective out of its bottle of carbolic-acid solution, and wash it off in warm saturated solution of boric acid.

This piece of protective is just large enough to cover the ulcer, and is smoothly pressed down upon it.

Dress the graft wounds in the same way.

Cover all with three or four thicknesses of bichloride gauze and a handful of bichloride cotton.

Bandage quite firmly.

Remove the dressing at the end of five days.

Wash the ulcer with warm saturated solution of boric acid squeezed out of a sponge.

Don't let the sponge hit the surface.

Add a new lot of grafts if there is room for them, and dress as before.

It will seldom be necessary to add more than two or three series of grafts.

Some operators prefer to cover the whole granulating surface at one sitting with half-inch long strips of skin.

I have seen perfect results after such treatment, but am satisfied that the rather slower method is the surer one.

If large strips of skin are to be applied, the scar left at the point from which they were removed will be noticeable, unless the following method is observed.

Shave and prepare, antiseptically, a space several inches long over the anterior aspect of the leg.

Remove a lanceolate-shaped riband of skin, which is long enough to contain sufficient material for covering the ulcer when cut into sections for that purpose.

The wound which is left after the removal of a strip of skin of this shape can be so nicely closed with catgut that the scar will be

scarcely apparent when the dressing is removed a couple of weeks later.

The usual dressing with iodoform, Lister protective, and bichloride gauze should be employed.

CLASS 2 and CLASS 3, Lacerated and Contused Wound; Variety 1, A Wound which is Equally Lacerated and Contused.

Classes 2 and 3 are inseparable.

The injury which causes a lacerated wound must contuse the tissues more or less; and, conversely, the injury which causes a contused wound must lacerate the tissues to a certain degree.

Whether a wound shall be called a lacerated one or a contused one will depend upon the preponderance of one or the other condition.

For variety first, in which the two conditions are about equally present in degree, a common scalp wound will give a good illustration.

A man, on alighting from his carriage, catches one foot in the wheel and falls, striking his head upon the smooth pavement.

The tissues at the point of impact were so

compressed for the moment between stone and bone that they were rendered dense and fragile ; and being fragile—broke.

The wound is two inches long, and looks almost as though it were made with a knife.

The wound extends from the middle line of the forehead back into the region of the hair.

Hemorrhage is profuse.

The margins of the wound are contused and inclined to be œdematous.

A small flap of pericranium has been torn up from the frontal bone.

Grains of sand and loose hairs have fallen in on the exposed tissues.

As the scalp skin is not very sensitive, this patient will not require an anæsthetic.

Let the patient lay his head on the rubber sheet.

Shave the skin for a distance of at least an inch on either side of the wound.

Wash away soapsuds and blood with 1–1,000 bichloride-of-mercury solution.

Wring out a towel in 1–1,000 bichloride solution, and lay it where it will receive instruments, etc., which are temporarily not in use.

Scrub your hands with 1–1,000 bichloride solution.

Remove with small forceps every single hair which has fallen into the wound.

Do not allow even half a hair to remain. Take out every grain of sand.

Trim away with a sharp scalpel any irregular or ragged bits of skin which would interfere with close apposition of the sides of the wound.

Sponge with 1–1,000 bichloride solution.

Control hemorrhage by pressure from time to time as you work.

Fasten the margins of torn pericranium together with small catgut.

For drainage purposes, employ a couple of strands of silk-worm-gut, fresh from their 1–30 carbolic-acid solution.

Lay these strands in the bottom of the wound, and allow them to project from its lower angle.

Suture the scalp margins smoothly and evenly together with interrupted catgut sutures, but do not tie the sutures until a few moments' pressure has stopped all bleeding.

Sprinkle iodoform along the line of suture. Take a half-inch wide strip of Lister protective out of its bottle of 1–30 carbolic-acid solution, and cover the wound line with it.

Lay a generous handful of gauze over the protective.

Cover all with a sufficiently large piece of gutta-percha tissue.

Bandage the dressing snugly in place. Remove the dressing seventy-two hours later.

Take out the catgut and the silk-worm-gut. Place a small dressing of gauze over the place where the wound was.

Leave the dressing in place for forty-eight hours.

I have treated wounds like the above described in children, in the middle-aged, and in the aged; in drunkards, invalids, and in tramps; and have never yet failed to get primary union when the wound was treated within ten hours after the injury.

Even when the skull had been fractured, the scalp wounds, treated properly, healed by primary union.

Compound and simple fractures are practi-

cally one and the same thing to the patient if he receive scientific antiseptic treatment in time.

Several years ago I happened to be in the position to see a large number of scalp wounds daily, and the effect of the different methods of treatment which they presented was of startling interest.

Some cases came to us with ordinary silk sutures in the wound, while hair and dirt remained beneath the surface.

Cases which were always in bad shape were the ones which had been treated openly and decorated with dried and hard dressings which stuck fast.

Many scalp wounds had been closed tightly, with no provision for drainage.

Others had been filled with some astringent iron-salt solution at the drug-store ; the person who applied it having learned how to stop hemorrhage.

Tight bandaging over pretty good dressings had frequently started a dangerous cellulitis.

By far the worst of all were the cases in

which the wounds had been closed with strips of adhesive plaster.

The margins of the wound had dried and adhered.

Serum was backed up in the deeper parts of the wound.

Antiseptic precautions had been omitted.

The wound was in a dangerous condition.

The physician never expects to injure the patient when he applies an unscientific dressing.

The man who is run over in the street by a carriage, never expects to be run over when he starts to cross the street. Men are run over in the street, however.

Patients' lives are really put in jeopardy by bad dressing of wounds.

A good many of us have seen men die because they were not properly treated surgically.

It is cruel to close a scalp wound with adhesive plaster, and allow the patient to go about with no additional dressing.

A dozen small plastered scalp wounds may do well.

How about the thirteenth case?

Develops cellulitis!

Is cellulitis necessary?

Not at all! It is superfluous. Especially if it occur in your own family.

If you are inclined to put plaster on a scalp wound—

Don't do it!

Withhold the microbe.

In no line of surgery is it easier to bungle a job than in treating the trivial wounds known as scalp wounds.

Treatment for the cerebral symptoms which accompany some scalp wounds requires no special consideration in these pages.

CLASSES 2 and 3, Lacerated and Contused Wound; Variety 2, An Inflamed Wound.

Suppose that the wound described under Variety 1 comes to you for the first time three days after the date of injury.

Some one has closed the wound tightly with silk sutures.

A compress moistened with carbolic-acid solution was placed over the wound, and the patient was told to keep this compress moist with the carbolic-acid solution.

The patient, as usual, failed to carry out directions.

The margins of the wound look puffy and red, and considerable constitutional disturbance exists.

On removing the silk sutures, and separating the margins of the wound, a drachm of "wrong-looking" discharge runs out.

Local treatment must be as follows :

Trim away hair from the margins of the wound with the razor.

Wash out the wound thoroughly with 1–1,000 bichloride-of-mercury solution.

Sprinkle iodoform over the exposed surface. Lay a strip of disinfected Lister protective over the wound.

Moisten a handful of bichloride gauze in 1–1,000 bichloride solution.

Squeeze the gauze as dry as possible.

Apply this dressing over the wound, and cover it with gutta-percha tissue.

Bandage lightly.

Change the dressing once a week, and redress in the same way.

The wound will granulate nicely so soon as proper treatment begins.

CLASSES 2 and 3, Lacerated and Contused Wound; Variety 3, A Wound with Preponderance of ~~Laceration~~ Contusion.

The patient has had his leg under a car-wheel, and has suffered a compound fracture of the tibia and fibula, at a point midway between the knee and the ankle.

The muscles and skin are badly lacerated and contused.

A two-inch-long hole in the skin has been produced by the sharp upper fragment of the tibia.

The anterior and posterior tibial arteries are torn at the seat of the wound.

Pressure with the finger on a toe-nail shows by the departure of blood from the underlying capillaries, and the return of the blood on removal of the finger, that circulation of blood still continues in the foot.

If the patient has lost so much blood that an immediate operation would be dangerous, then hot bottles about the legs and arms, aromatic spirits of ammonia internally, and brandy hypodermically, may be supplemented by injecting slowly into the radial artery, or into a large vein, several ounces of Schwartz' solu-

tion (℞ Aquæ Oj, sodii chloridi ʒi., liquoris potassæ gtt. ii.).

When the heart beats regularly and strongly, proceed with the operation.

We suppose that a tourniquet has been applied to the femoral artery, and that iodoform has been thrown on the wound, before beginning the restorative measures.

If the patient suffer from shock alone, and not from hemorrhage, I should have no hesitation, as a general thing, in proceeding at once to operate.

The patient's heart will usually become stronger in its action so soon as the full effects of ether are felt, and the condition of shock does not often remain for any length of time after the operation has been completed in a case like the one under consideration.

Get the following things in shape for the operation :

Rubber sheet.

Irrigator filled with 1–2,000 bichloride solution.

Washbowl filled with 1–2,000 bichloride solution for washing sponges.

Bowl of 1–1,000 bichloride solution for the hands of the operator and assistants, for the patient's skin, and for wetting the towels.

Dish filled with 1–30 carbolic-acid solution for large instruments.

Dish filled with 1–30 carbolic-acid solution for small instruments.

Wide-mouthed bottle filled with catgut in alcohol; wide-mouthed bottle of Lister protective in 1–30 carbolic-acid solution.

Silver wire or silk-worm-gut in 1–30 carbolic-acid solution.

Iodoform.

Bichloride gauze.

Bichloride cotton.

Rubber drainage-tubes in 1–30 carbolic-acid solution.

Razor and nail-brush.

Plaster of Paris bandages.

Bichloride-of-mercury gauze bandages.

Plain bandages.

Towels.

Suspension apparatus described on page 112.

Anæsthetize the patient.

See that the tourniquet or elastic bandages are all right.

Put the rubber sheet under the leg.

Shave the leg from the knee to the ankle.

Wash away soapsuds and blood with 1–1,000 bichloride solution, and scrub the leg with the nail-brush at the same time.

Wring out towels in 1–1,000 bichloride solution, and place them under the leg; around the leg, above and below the injured part; and on the table where instruments are to be laid.

All hands which are to touch the wound or the dressings must be scrubbed in 1–1,000 bichloride solution.

Open the wound so freely with a large scalpel that the injured tissues may be dealt with.

Be careful not to have too small an opening.

Irrigate with the 1–2,000 bichloride solution pretty constantly during the operation.

Make a very free counter-opening over the fractured part of the fibula.

Be cautious about the size of this opening, and not have it too small.

Trim away all muscular and other soft tis-

sues which are so crushed and lacerated that they cannot live.

Cut away rough or loose margins and points of bone, and remove separated fragments.

Shape the remaining fragments so that they will fit together as well as possible.

Drill holes in the ends of the fragments, so that they can be fastened together with silver wire (or with silk-worm-gut).

Take the wires out of the carbolic-acid solution, and fasten the bones together with them in such a way that surrounding tissues will not be irritated by their presence.

These bone sutures are not to be removed, but are to be carried about by the patient after he is well.

If divided large nerves are found, suture their trimmed ends together with small catgut.

Ligate arteries with No. 7 catgut.

Unite muscular tissues with catgut sutures. If ends of a divided muscle cannot be brought together, an approximation to this condition can be made by means of long sutures, and the space between the ends will fill with new tissue later, thus preserving the identity of the muscle.

I have seen a space of at least two inches filled in in this way, although at the time of operation several spectators were afraid that "aiming the ends of a muscle at each other" from such a distance would be of no avail.

Dry the wound with a sponge or give it a final washing with 1–5,000 bichloride solution.

Put two large-calibre rubber drainage-tubes where they will best act as drainers.

Bring cutaneous margins loosely together with catgut sutures.

Powder iodoform over the wound.

Put Lister protective over all exposed parts of the wound and along the lines of suture.

Wring out a couple of handfuls of bichloride gauze in an 1–2,000 bichloride solution and apply about the wound.

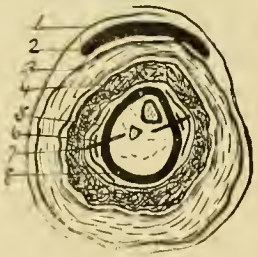
Fasten the dressing loosely in place with a bichloride gauze bandage.

Serum will run through slightly moist gauze much better than through dry gauze, but wet gauze might excite suppuration, and suppuration is to be avoided in this wound.

Wind five yards of bichloride gauze about the leg between the knee and the ankle.

Bandage the gauze lightly in place with a bandage of the same material.

Put a two-inch thick layer of bichloride cotton around the gauze from the knee to the ankle.



THEORETICAL SECTION THROUGH LEG AND DRESSING AT A POINT SITUATED NEAR THE FRACTURE.

1. Ordinary bandage.
2. Plaster-of-Paris splint.
3. Bichloride cotton.
4. Bichloride gauze.
5. Lister protective.
6. Safety-pin.
7. Drainage-tube.
8. Leg.

Apply an anterior plaster of Paris splint, and bandage it in place.

Make the splint by running wet plaster of Paris bandages up and down on the anterior aspect of the dressing, until a sufficient thickness for holding the leg firmly has been applied.

Sling the leg by means of broad bandages from a bar above the bed.

The higher the leg is elevated, the more comfortable will the patient be.

After a week has passed the dressing must be changed for the purpose of removing the drainage-tubes.

Do the changing under irrigation with 1–1,000 bichloride-of-mercury solution.

Prepare your hands as carefully as for a fresh wound.

Remove the rubber drainage-tubes.

Insert absorbable bone-drains in their place.

Sprinkle more iodoform about the wound.

Apply Lister protective and the rest of the dressing in the same manner as when the leg was first dressed.

If one of the new drainage-tubes happen to hit the edge of the bed while being handed to the surgeon, it must go back into its bottle, and another one must be used in its place,—just as with the previously inserted rubber tubes.

If a safety-pin for the tube be touched by an assistant whose hands are unprepared that safety-pin must be discarded.

If a bit of the new dressing is touched by unprepared hands, that bit of dressing must not be used for the leg.

Sophists who reason out the absurdity of these details have suppuration in the cases of compound fracture of the tibia and fibula which they treat.

Suppuration should not occur in these cases so often as suppuration after simple fracture.

Surgical sophists do much harm to the cause of antiseptic surgery, because their conclusions seem very plausible to persons who have had no practical experience with scientific antisepsis.

After the leg has been redressed, it should be again elevated as before.

Keep the patient in bed for six weeks more, and do not change the dressing until six weeks have passed.

The patient can sit up in bed during this time, and can read and smoke, and carry on business conversations, or enjoy social chats with companions, just as though his leg were not broken.

When the dressing is removed, the character of the union at the point of fracture will deter-

mine what protection in the way of a splint is needed.

Hot and cold douching, massage, and passive joint motion will be required after removal of the dressing.

Such a case will have run a very different course from the cases of this sort which most of us heard about when we studied medicine at college.

We were then taught to dread the danger from pyæmia, septicæmia, erysipelas, exhausting suppuration, and non-union.

Now we have only the non-union to fear, and when suppuration is avoided, this accident must obviously occur much less frequently than formerly.

The discharge which is found in a six-weeks'-old dressing will be gelatinous in consistency, and under the microscope will be found to contain a large amount of granular débris and a small proportion of pus corpuscles.

In connection with this sort of case, I wish to make objection to the method of working for primary occlusion in cases where the opening in the skin is small.

It is unfortunate that any one discovered that primary occlusion in compound fractures would give good results.

A large proportion of these cases in question go remarkably well.

I have treated several cases by this method, and in all of them the healing course was eminently satisfactory.

But!

Sometimes these cases do not do well.

When they do not do well, they do very, very badly.

They assume a septic condition of some sort.

This septic condition cannot occur in a recent compound fracture which has been treated by the method of opening up the wound and managing the injured tissues with scientific antiseptic precautions.

The surgeon will have no anxiety for the welfare of the patient after this has been done.

He will not have to wait and see what the wound will do.

He knows just what it will do.

CLASSES 2 and 3, Lacerated and Contused Wound; Variety 4, A Gunshot Wound.

A man's arm is struck by a Number 32 bullet, fired from a revolver at close range.

The bullet crushes the external condyle of the humerus, tears away part of the shaft of the humerus, and breaking into a dozen pieces remains imbedded in the bone.

The synovial cavity at the elbow is opened by a small fissure.

The nearest doctor has been called in, and has introduced through the hole in the skin about every thing which would enter it, from his silver probe to his catheter, and forceps of every sort.

He will wish that he had a Nelaton's probe in order to locate the bullet, that he may pull it out.

In these cases it is not necessary to introduce even a clean silver probe before anæsthetizing the patient.

The wound to be decently treated must be well opened any way, and then is the proper time for examining the wound.

Make the usual preparations for doing an antiseptic operation.

Put the patient under the influence of ether.

Apply Esmarch's bandage to the injured arm.

Put the rubber sheet in place.

Shave the arm about the elbow, and several inches above and below it.

Wash away soapsuds and blood with 1–1,000 bichloride-of-mercury solution.

Wring out four towels in 1–1,000 bichloride solution.

Wrap one of them about the arm above the elbow. Put another one about the arm below the elbow. Lay one towel under the elbow on the rubber sheet.

Spread the last one out on the operating-table and put instruments, etc., on it when they are laid aside for a moment during the operation.

All parties who are to touch the wound or the instruments or the dressings must scrub their hands in 1–1,000 bichloride solution.

Irrigate during the operation with 1–2,000 bichloride solution.

Take the probe out of the dish of carbolic-acid solution and determine to some extent the nature of the injury to the bone.

Make a cut which includes the bullet hole in the skin, and which is long enough to allow of examination and treatment of the shattered portion of the humerus.

Trim away destroyed soft tissue in the track of the bullet.

Pull out the small fragments of bone and of bullet.

Chisel off rough margins and points of bone.

It will not be necessary to open the synovial cavity widely and wash it out unless inflammatory processes have developed in the wound previous to the operation.

Ligate large blood-vessels with No. 7 catgut.

Remove the Esmarch's bandage.

Ligate small bleeding vessels with No. 8 catgut.

Stop all oozing of blood.

If oozing can not be easily stopped, insert the catgut sutures ready for closing the wound, but do not close it.

Pack the wound with one or two large sponges.

Hold the sponges in place for twenty

minutes or longer with a bichloride gauze bandage.

Remove the bandage and the sponges.

Lay a bone drainage-tube along the bottom of the wound.

Tie the catgut sutures which are already inserted.

Add a few more superficial ones, if necessary.

Sprinkle iodoform over the region of the wound.

Lay a strip of Lister proctective along the line of sutures, and tear a hole in it opposite the emerging drainage-tube end.

Envelop the elbow in loose bichloride gauze, and about the gauze wrap a generous supply of bichloride cotton.

Put the elbow in a right-angled position before applying the dressings. Hold it there afterward with a piece of card-board, which is cut as a right-angled splint, and bandaged on the outside of the dressing.

Sling the arm from the neck and put a bandage about the arm and chest.

Do not keep the patient in bed.

Remove the first dressing at the end of the

third week, and then begin passive motion at the joint if it is stiff.

In gunshot wounds, involving soft parts alone — not injuring abdominal contents,— and which are presumably free from pieces of clothing or of wadding, I believe the best routine treatment to consist in a simple antiseptic dressing of the cutaneous perforations with iodoform, bichloride gauze, and gutta-percha tissue; a couple of strands of catgut being inserted for a short distance into each bullet hole, in order to allow of free escape of serum. Absolute rest must be insisted upon.

Where bone is fractured by a bullet, the only rational treatment is similar to that described above in connection with the bullet in the humerus.

CLASS 4, Punctured Wound; Variety 1, A Penetrating Wound of the Knee-Joint.

A knife blade has been thrust into the knee-joint, and the patient applies for surgical help shortly afterward.

Put the patient on the table.

Spread the rubber sheet under the injured limb.

Wash the skin in the vicinity of the wound very gently with 1–1,000 bichloride-of-mercury solution.

Stick a couple of strands of catgut between the margins of the wound—just deeply enough to allow serum to come to the surface.

Sprinkle iodoform over the wound.

Put a litttle piece of Lister protective over the cut.

Apply a few layers of moistened bichloride gauze, and over this a handful of dry bichloride gauze.

Cover all with gutta-percha tissue, so that effusions from the wound will not dry and close the opening in the skin.

Immobilize the joint.

Be certain that the whole knee is put in a state of rest.

The slightest amount of movement is hazardous. If no inflammatory symptoms occur, the dressing may be changed forty-eight hours later and the catgut removed.

Replace the rest of the dressing, and keep the knee quiet for three or four days longer.

If in spite of the above-described precau-

tions, the deep parts become inflamed and the joint is swollen, hot, and red with symptoms of synovitis, there is just one thing to be done.

Don't call a consultation ; because some one may want to wait a little while.

Don't *ask* any one's advice, but *tell* your assistants what is going to be done.

Anæsthetize the patient.

Apply the tourniquet to the femoral artery. Shave the skin about the entire knee. Wash off soapsuds with 1–1,000 bichloride-of-mercury solution, and scrub the skin with a nail-brush at the same time.

Wring out towels in 1–1,000 bichloride solution. Place one of them on the rubber sheet under the knee.

Wrap one of them about the leg above the knee, and another one about the leg below the knee.

Hands are prepared as usual with 1–1,000 bichloride-of-mercury solution.

The irrigator is filled with 1–1,000 bichloride solution,

Make a two-inch-long opening into the joint

in such a way as to include the knife wound in the scalpel cut.

Make a counter opening into the joint at a point situated just above and external to the attachment of the biceps tendon.

Ask one of the assistants to scrub the nozzle of the irrigator with 1–1,000 bichloride solution.

Put the nozzle of the irrigator into one of the openings in the joint, and wash the interior of the joint thoroughly.

To wash the joint thoroughly the synovial cavity must be distended to its fullest extent several times in rapid succession with the antiseptic solution, and each time that it is distended the knee should be vigorously rubbed, flexed, and extended.

After washing the joint for a few minutes with the 1–1,000 solution, the irrigator should be filled with 1–5,000 bichloride solution, and several flushings given with the latter. Some of the solution will remain in the joint, and the 1–1,000 solution is rather too strong to leave there with safety.

Put a rubber drainage-tube in each of the openings into the joint.

Fasten a safety-pin in the emerging margin of each tube.

Suture the cutaneous wounds.

Sprinkle iodoform about the wounds.

Apply a couple of strips of Lister protective, and cut holes in the protective opposite the drainage-tube openings.

Envelop the knee in several handfuls of bichloride gauze.

Bandage a large wad of bichloride cotton around the gauze.

Put a splint along either side of the leg over the dressings, and immobilize the joint.

Elevate the leg.

Change the dressing a week later for the purpose of removing the drainage-tubes.

Apply a smaller but similar dressing.

Remove the latter ten days later.

If any one object to the operation as adding more danger to the patient's condition, that person has had no surgical experience—at least not what we call surgical experience to-day.

CLASS 4, Punctured Wounds; Variety 2, A Deep Palmar Wound.

A very common wound is the one caused by

thrusting a large splinter of wood, or some other rough-pointed object, into the thenar eminence, or into the tissues between the metacarpal bones of the thumb and index-finger.

Tetanus or cellulitis is particularly apt to follow these wounds.

The reason is, perhaps, because the muscular and fibrous planes bear such a relation to each other in the way of position, that discharges from the deep parts of the wound find difficulty in escaping; and because the peculiarly exciting effect of inflammation in dense fibrous tissue like palmar fascia produces a particularly deep impression, on account of the close proximity of the many nerves which belong to the hand.

The hand and the foot are structurally homologous, and their wounds are in ways inflammatory, analogous.

We may suppose, then, that the certain growth in the wound of various and specific micro-organisms, in association with a co-existing non-resisting condition of the ordinarily repellant nerves, produces the disaster of tetanus or cellulitis.

Both of the diseases in question are avoided if the patient be properly treated shortly after the wound has been made.

Proper treatment is as follows :

Apply Esmarch's bandage to the arm above the injured hand.

Place the hand on a part of the rubber sheet. Scrub the hand with 1–1,000 bichloride solution.

Wring out a towel in 1–1,000 bichloride solution.

Put the towel on the rubber sheet under the hand.

Scrub your own hands in 1–1,000 bichloride solution.

Open the wound freely enough to allow of removal of any foreign body, and to admit of easy ligation of blood-vessels, or of insertion of drainage apparatus.

If the wounding splinter have penetrated nearly to the dorsum of the hand, it is better to complete the perforation with a scalpel.

Send a stream of 1–2,000 bichloride solution through the wound.

Swell half a dozen strands of catgut in a saucer of 1–2,000 bichloride solution.

Pass the strands into or through the wound for purposes of drainage.

Sprinkle iodoform where it is needed.

Do not close the wound.

Lay Lister protective on the skin-wound or wounds.

Wrap loose bichloride gauze about the hand.

Add bichloride cotton over the gauze.

Bandage firmly enough to keep the hand at rest.

Suspend the arm in a sling from the neck.

Remove the dressing twelve or fourteen days later. Almost no sign of the wound should remain at that time.

Class 4, Punctured Wound; Variety 3, An Inflamed Wound.

The wound described under Variety 2 has been treated without antiseptic precautions.

You see it for the first time when signs of active inflammation have developed.

The treatment should be the same as though it were a fresh wound, with three exceptions:

First exception—Wash the depths of the

wound very thoroughly with 1–1,000 bichloride solution.

Second exception—Wet the gauze part of the dressing before applying it, and cover with gutta-percha tissue, so that it will remain wet.

Third exception—Exchange the wet dressing forty-eight hours later for a dry one.

The repeated sighs of relief which the patient will give after his hand has been properly dressed are always striking.

Class 5, Poisoned Wound; Variety 1, Dog Bite.

Canines, when in an aggressive mood, add a vigorous shake to their bite.

If the teeth enter the soft tissues of an animal, the contusion which follows the shaking is often very extensive.

This is why dog bites are especially painful, and why badly treated cases cause so much misfortune.

A rabid dog seizes a child by the upper arm, and the teeth penetrate the muscles.

Anæsthetize the patient.

Put the rubber sheet in place.

Shave the skin of the whole upper arm.

Wash the skin with 1–1,000 bichloride solution.

Wring out a towel in 1–1,000 bichloride solution, and spread it on the rubber sheet under the arm.

Lay another similar towel on the table, where instruments are to be laid when they are out of the dishes of carbolic-acid solution and are not in use.

Prepare your hands as usual.

Make a free incision through the skin, in the vicinity of each tooth hole, and include this tooth mark in the cut.

Continue the incision down through the muscular tissue until the deepest contused point is laid open.

Put a couple of quarts of 1–500 bichloride solution in the irrigator, and wash the wounds for ten minutes with it.

Bichloride solution of this strength must not be left in the wound.

Pour a couple of quarts of 1–5,000 bichloride solution slowly over the wounded tissues, and rub them gently with your finger, in order that

the strong bichloride solution may be carried away.

Sprinkle a very thin layer of iodoform over the exposed surfaces, and then tuck a small strip of Lister protective into each wound, in order to prevent primary union.

Wind several layers of bichloride gauze loosely about the arm.

Cover the gauze with a two-inch-thick layer of bichloride cotton.

Bandage the whole arm to the chest to prevent motion.

Change the dressing under irrigation with 1–5,000 bichloride solution five days later.

Remove the Lister protective.

Sprinkle a small amount of iodoform over the wounds again.

Place strips of Lister protective over the wounds and not in them.

Apply the gauze and cotton dressing, and bandage the arm to the chest as before.

Do not change this second dressing until you believe the wound to be healed.

The incisions will have exposed the poisoned parts of the wound.

The strong bichloride solution will undoubtedly have destroyed the microbes from the dog's teeth.

Serum from the contused tissues will have escaped externally, instead of infiltrating the connective tissues and causing swelling and pain.

The operation will have been done antiseptically, and healing will go on under one dressing with great rapidity.

CLASS 5, Poisoned Wound; Variety 2, Snake Bite.

While hunting with a friend the latter is bitten in the leg by a rattlesnake.

Don't stop to kill the snake.

Tear open the breeches leg.

Fasten a handkerchief or strap about the leg above the wound so firmly that venous circulation will be impeded.

It will be hard to tie the improvised tourniquet tightly enough; so it will be best to tie it very loosely, and then twist it tightly in the common way with a stick.

Open the one or two holes made by the

snake's fangs with your knife, and open them so widely that the whole depth of the wound is exposed.

The small wounds made by the other teeth of the snake are harmless and need receive no attention.

Allow six or eight ounces of blood to escape from the knife cut, if so much as that will run out, and, at the same time, rub the wound with your finger in order to dislodge any of the tenacious albuminous poison which remains.

Remove the tourniquet.

Wash the wound out with whiskey if you happen to have it with you.

Stop hemorrhage by tying a wad of crushed leaves in the wound with the handkerchief passed around the leg at that point.

Get to a place where you can wash the wound out with 1–500 bichloride-of-mercury solution, and dress it antiseptically.

Do not poison the patient with unreasonably large doses of whiskey given internally.

I have seen whiskey cause much more damage to a patient than the rattlesnake bite for which it was given caused.

If a layman who knew nothing of anatomy wished to treat a snake bite in the way described above, he should make the cut by passing the tip of the knife blade down into the wound and cutting out, instead of cutting directly down as a surgeon would do.

He should also make the cut in the long axis of the limb, in order to avoid cutting large blood-vessels.

He must remember that hemorrhage from any bleeding vessel can always be stopped by putting a finger directly upon that vessel, and that plenty of time will then be given for thinking of a better method for applying the pressure.

A solution of one grain of corrosive sublimate in two teaspoonfuls of water, injected forcibly into a freshly-made fang wound with a small syringe, would unquestionably destroy all of the snake poison in the wound, and obviate the necessity for the crude surgery just referred to.

Three or four syringefuls of the solution may be thrown in succession into each fang wound, which should be syringed out five minutes later with pure water.

White of egg, which is chemically very much like snake poison, is instantly coagulated in the presence of strong corrosive-sublimate solution.

CLASS 6, Burned Wounds.

Dupuytren classifies burns in six degrees.

His burn of the first degree presents a hyperæmia of the skin, with no exposure to the air of tissues beneath the cuticle.

This burn is not a wound, of course, any more than a non-penetrating dog bite is a wound.

Burns of all other degrees, which expose the tissues beneath the cuticle to the air, are theoretically and practically wounds in all of their attributes.

CLASS 6, Burned Wound; Variety 1, A Limited Burn of the Second Degree.

A child upsets the teakettle and burns the right leg from the knee to the ankle with hot water.

Large blebs and vesicles are raised above the surrounding skin, and where the cuticle over a bleb has ruptured, the underlying true skin is exposed.

Several square inches of true skin have been exposed in this way.

In order to do thorough work it will be best to anæsthetize the child.

This having been done, the little patient is placed upon the rubber sheet on the table.

The skin in the vicinity of the burned region is shaved.

Towels wrung out in 1–1,000 bichloride solution are spread on the rubber sheet under the limb and are wrapped about the thigh and foot.

Your hands having been scrubbed in 1–1,000 bichloride solution, a pair of scissors and a pair of thumb forceps are taken out of the dish of carbolic-acid solution at your side, and while an assistant irrigates with 1–2,000 bichloride solution, strip and pull away all loose cuticle and all of the cuticle which covers the unruptured blebs.

This having been done, the towels are replaced by fresh ones, and you proceed to rinse the leg thoroughly with 1–5,000 bichloride solution.

Take two-inch-wide strips of Lister protective

out of the bottle of carbolic-acid solution and rinse them off in 1–5,000 bichloride solution.

Lay them smoothly over the wounds in such a way that all exposed surface will be covered as though with a new skin of the pretty green silk.

Sprinkle iodoform along all margins of protective.

Wrap bichloride gauze smoothly about the limb to the thickness of one inch.

See that the gauze extends beyond the distal and proximal limits of the protective.

Cover the gauze with a two-inch-thick layer of bichloride cotton.

Bandage snugly.

Elevate the limb on pillows.

Sprinkle iodoform on damp places in the dressing if serum run through, and add an extra wad of bichloride cotton.

After seven or eight days have passed, cut open one end of the dressing and see if all is well.

I have never seen a burn of the above character, treated in the manner described,

which failed to heal completely under one dressing by the tenth day.

Two cases were already suppurating when they came for treatment, but the suppuration did not continue after the scientific dressing was applied.

The reasoning through which the scientific method for dressing the burn is deduced, is as follows:

1. The condition of anæsthesia protects against the shock and irritation which would otherwise follow surgical disturbance of the wound.

Further, if an anæsthetic were not given, the child's cries would excite a badly timed sympathy—and bungling work would result.

2. The antiseptically prepared instruments, hands, and surroundings add no active microbes to the wound.

3. Shaving the healthy skin in the vicinity of the burn removes microbes, which would quickly enter the land of milk and honey if they were allowed to remain within sight of it.

4. Removing separated cuticle, which must

decompose after offering temporary protection, enables us to reach every part of the wound with 1–2,000 bichloride solution.

The 1–2,000 bichloride solution washes away microbe food and destroys microbes.

5. The final washing with 1–5,000 bichloride solution carries away the strong 1–2,000 solution, which might irritate later.

6. The Lister protective prevents all external irritation of the wound.

Exuded serum easily runs out of it into the waiting gauze.

The epithelium cells shoot along under the protective without interruption.

7. The iodoform, and the bichloride of mercury in the gauze and cotton, offer objection to microbe growth in the serum.

The gauze and cotton are principally useful as absorbers of serum and as holders of the bichloride of mercury.

CLASS 6, Burned Wound; Variety 2, An Extensive Burn of the Second Degree.

Extensive burns of the second degree often occur after steam explosions.

Large surfaces of cuticle are destroyed, and

surgical dressings can be kept in place with great difficulty only.

A patient whose skin has been burned over one third of its superficial inches, may be treated according to the following method :

Anæsthetize the patient with chloroform.

Have ready, a couple of the disinfected sponges ; a basin of 1–5,000 bichloride solution for washing sponges ; a basin of 1–30 carbolic-acid solution for the scissors and forceps ; a box of subnitrate of bismuth, and a camel's-hair brush ; a yard or two of soft linen cloth ; and narrow strips of rubber plaster.

It will not be possible to treat these wounds antiseptically, but a fairly close approach to that condition may be brought about.

With scissors and forceps remove all separated cuticle.

Wash the surface clean with the 1–5,000 bichloride solution as you proceed, and sprinkle subnitrate of bismuth generously over the exposed surfaces before the bichloride solution has dried.

Cover each patch of bismuth-sprinkled burn with a single layer of the soft linen cloth.

Fasten each piece of cloth in place with short strips of rubber plaster across its corners.

Once or twice daily afterward, two of the corners of each piece of cloth should be loosened.

Lift up the cloth.

Gently detach the shell of subnitrate of bismuth which covers a little collection of discharge.

Sprinkle on enough fresh bismuth to absorb the remaining discharge at that point.

Do not touch the wounds.

The discharge will be very small in quantity, amounting to not more than six or eight drachms daily when a large man is burned over one third of his skin.

Usually, in a burn of this kind, some few points of skin will be burned to the third degree,—a portion of the thickness of the true skin being destroyed.

When this is the case the destroyed part will become dry and horny under the subnitrate-of-bismuth treatment, and will separate as a dry slough without decomposition.

Aid the separation with a sharp scalpel, and

keep the granulations covered with fresh bismuth powder.

Whether the patient live or not will very frequently depend upon your way of handling the constitutional symptoms.

General rational principles should govern the treatment.

Every case will present its own peculiarities, and consequently I do not care to enter into the description of the imposing array of groupings of symptoms which would be presented in a treatise on the treatment as a whole.

It may be well to make a few brief suggestions however.

During the stage of depression, which lasts for one or two days, the patient will remain in a state of shock or of collapse, unless he die or receive good treatment.

Immersion in a bath-tub of warm water will bring such a patient temporarily into a comparatively comfortable condition.

Stimulation on general principles must follow. Chloroform given to the surgical degree will usually relieve the condition of shock or collapse, and if then the burns be dressed and

morphine given, the patient will be ready to improve regularly and steadily under your treatment.

So soon as the second stage appears—that of reaction,—the bowels must be opened freely with a saline cathartic.

The congested kidneys must receive attention through citrate of potassium and digitalis and thorough cupping or poulticing.

Vomiting may be controlled with belladonna.

Nutrition should be exclusively through rectal enemata of peptonised milk for a few days.

Do not make the thoughtless mistake of adding raw egg or any other undigested food material to the enema.

If a sudden failing during the second stage should be associated with absence of liver dulness—showing escape of gas into the peritoneal cavity,—you would expect to make a diagnosis of perforating duodenal ulcer pretty promptly.

The diagnosis having been made, the indication would seem to be for laparotomy on the spot, with resection of intestine, or closure of the perforations by means of Lembert's suture.

I do not know that any one has done this as yet, but it should have been done, just as surely as operation in case of perforating ulcer of the stomach should have been done.

The reason for employing the described method of local treatment in an extensive burn of the second degree is as follows:

1. Anæsthetizing the patient with chloroform brings him out of the condition of shock.

Dressing the wounds during sleep adds nothing to the shock.

2. Removal of separated cuticle disposes of dead animal matter, which would decompose if left in contact with the wound.

3. Washing with 1–5,000 bichloride solution removes microbe food, and checks the development of microbes to a certain extent.

4. Subnitrate of bismuth is a bland and unirritating wound dressing.

It is a tolerably good antiseptic because it dries the discharges.

Its slight astringency stimulates.

The discharge from the wound unites the powder in the form of a crust which fits like new skin.

5. The single layer of linen cloth protects the loose bismuth powder, and allows of drying of the absorbed discharge, while the cloth itself remains clean, or nearly so.

CLASS 6, Burned Wound; Variety 3, A Limited Burn of the Third or Fourth Degree.

A burn of the third degree, in which the true skin is destroyed through a part of its thickness; or a burn of the fourth degree, in which the true skin is destroyed through its entire thickness, is often caused by a strong mineral acid or by boiling or burning oil.

A laborer accidentally spills boiling oil over his hand and wrist, and comes to you at once for treatment.

A few blebs remain at the upper part of the wound, but the cuticle lies in loose folds below that point, and serum is being exuded rapidly.

The exposed true skin is unnaturally white, or unnaturally red.

From the character of the injury the true skin is supposed to be destroyed through a part or a whole of its thickness.

Submerge the hand and wrist in a bowl of warm 1–5,000 bichloride-of-mercury solution.

Remove all of the loose cuticle, and open the blebs, cutting away the cuticle which helped form them.

Take the hand out of the bowl and put it on a towel wrung out in 1–1,000 bichloride solution.

Wash your own hands in bichloride solution of the same strength.

Remove the smallest pieces of remaining loose cuticle.

They can do only harm by their presence.

Gently shave the unburned skin in the vicinity of the wrist.

Put the hand and wrist in a fresh bowl of warm 1–5,000 bichloride solution, and wait for five minutes.

Lay the hand and wrist again on the disinfected towel.

Sprinkle iodoform over any palmar cuticle which may remain attached.

In a bowl of 1–5,000 bichloride solution wash the carbolic-acid solution from strips of Lister protective.

Wind the protective very smoothly about the fingers, hand, and wrist.

Sprinkle iodoform over all.

Wrap a thick layer of bichloride gauze about the hand and lower part of the arm.

Cover the gauze with bichloride cotton.

Bandage snugly.

Lay the hand in its dressing on the opposite shoulder, and hold it there by means of bandages for two or three days.

Don't change the dressing until a decomposition odor is noticed about it.

This odor should not be found until ten days or two weeks have passed.

When you change the dressing, put the hand in a basin of warm 1–5,000 bichloride solution.

Trim away loose slough with a sharp scalpel and a pair of forceps.

Rub iodoform into any remaining slough.

Dress as before.

Leave untouched as before.

Change as before.

Plant skin-grafts on large granulating surfaces after all slough has been removed.

The amount of suppuration from this wound should be trifling, and seldom sufficient to necessite a change of dressing on its account.

If a case similar to the above has been treated in some ordinary way, and large granulating surfaces are struggling to furnish enough pus to float off the unwelcome dressings, the method of dressing would be after the following order:

Wash away the pus with syringefuls of warm 1–5,000 bichloride solution.

Mix fluid extract of ergot with equal parts of warm water.

Squeeze this solution from a sponge over the whole granulating surface.

It will cause smarting for a moment.

Dress with disinfected Lister protective, iodoform, and bichloride cotton.

Repeat the process once daily until the daily dressing can be deferred, and change afterward as seldom as possible.

Profuse suppuration will sometimes be cut short with one such application of ergot.

The reason for this is probably because the ergot produces a local stimulation of the vaso-

motor nerve filaments, causing a condition of high tension in the blood-vessels of the wound, and thereby stopping the transmigration of leucocytes, which can not easily pass through these vessel walls.

In one case of mine, both of the hands and wrists were badly burned, and several ounces of pus were being daily thrown off from ugly, misshapen granulating surfaces.

I experimented here by using ergot, protective, and gauze, on the left hand, and a dressing of iodoform and vaseline, spread on sheet lint, for the right hand.

The discharge from the left extremity was reduced from ounces to drachms in twenty-four hours, and in a week nearly all of the granulating surface had contracted firmly, and was covered with a delicate pearly-blue film of exquisite new epithelium.

The right hand and wrist remained in their former condition, with hardly an appreciable attempt at repair, until, at the end of a week, I commenced proper treatment. The result of this treatment was as marked as it had been with the left hand.

Suppuration from a flat surface, or from a surface covered with ill-defined granulations, is not so easily controlled.

In well-managed burned wounds, suppuration requiring special treatment will not occur.

Class 6, Burned Wounds; Variety 4, An Extensive Burn of the Third and Fourth Degrees.

When a woman's dress catches fire, a portion of her skin is usually burned to the third and fourth degrees.

In the majority of cases the burn extends from the tops of the shoes to the waist; and from the ends of the fingers to the line where the sleeve encircles the arm.

Sometimes a part of the skin about the face is scorched, although in several of the cases of the kind which I have treated the face has not been burned.

A serious degree of shock follows such a burn.

If you have not sufficient confidence in chloroform as a shock reliever in a case of the kind, put the patient—clothes and all—into a

bath-tub full of water, at the temperature of about 110° F.

Anæsthetize so soon as the marked signs of shock have been relieved.

The best way is to give chloroform at once, and to the surgical degree.

When this has been done, remove all clothing. Do not remove any of the clothing before giving the chloroform.

Put the patient on the table with the rubber sheet under her.

Irrigate with 1–2,000 bichloride of mercury while you remove every particle of loosened and destroyed cuticle and all adhering bits of burned cloth.

Scrub the burned surfaces gently but thoroughly with a disinfected sponge, while 1–2,000 bichloride solution, poured in a large stream from a pitcher, carries off every thing which the sponge loosens.

Shave the unburned skin in the vicinity of the burned regions.

Give a final flushing with 1–2,000 bichloride solution.

Wipe the rubber sheet as dry and clean as possible.

Wring out several towels in a washbowl full of 1–2,000 bichloride-of-mercury solution. Spread them out on the rubber sheet under the patient.

Scrub your hands in 1–2,000 bichloride solution.

Wash the burned surfaces with a liberal amount of 1–5,000 bichloride solution.

Remove long three-inch-wide strips of Lister protective from the 1–30 carbolic-acid solution, and wash them off in the 1–5,000 bichloride-of-mercury solution.

Be careful that the strips of protective touch nothing which is not disinfected.

Wind them smoothly and in a single layer around the legs, and lay shorter pieces upon the buttocks.

A catgut suture here and there through the skin will hold in place such pieces of protective as would be inclined to slip.

Tear the protective in narrow strips for the hands and arms.

Sprinkle iodoform along all margins of protective.

Cover all applied protective with a two-inch-

thick layer of bichloride gauze, and allow the gauze to project proximally and distally for several inches beyond the limits of the protective.

Fasten the gauze snugly in place with a bichloride gauze bandage.

Apply over this a three-inch-thick layer of bichloride cotton.

Bandage rather firmly.

The burns about the face will probably be of the first degree, and should be treated by applying ordinary oil-mixed white paint on strips of old linen.

Cover the dressing with gutta-percha tissue to keep it from drying, and for neatness' sake.

White paint relieves the pain more quickly and completely than any other substance which I have employed.

If the patient can now be slung in a hammock, we have an ideal condition of things.

The limbs can be elevated ; the catheter can be used, and the rectal nutrient enemata are easily given, several hammock strands having been cut. Additional dressing may be added where serum runs through the permanent one ;

and all with a minimum degree of disturbance to the patient.

Moreover, the dressings dry evenly on all sides, so that the unwished-for poultice-like effect of collections of serum under the buttocks is avoided.

If it is not convenient to put the patient in a hammock, the layer of bichloride cotton will probably have to be changed in two or three days, on account of serous saturation.

Carefully avoid disturbing the gauze and deeper parts of the dressing when the bichloride cotton layer is removed.

In treating the all-important constitutional symptoms, a reference to the suggestions made on page 108 will be in order.

Remove all dressings from the wounds for the first time, when a decomposition odor is noticed.

This odor should not appear before the end of the second week.

Change the dressings under irrigation with 1–5,000 bichloride-of-mercury solution, and anæsthetize the patient for the occasion.

A large part of the burn will have been of

the second degree, and this part will be healed or nearly so.

Cut away loosened margins and the upper surfaces of the sloughs with a sharp scalpel, and rub iodoform into the remainder of each slough.

If the parts which were burned to the second degree are not healed, the original dressing must be renewed, and left in place for another week.

Afterward, treat the sloughs and granulating surfaces with subnitrate of bismuth according to the method previously described.

Begin skin-grafting a week or two later.

The dressings for a burn of this kind are rather expensive.

But!

Expense is not to be considered.

And!

The actual cost is not very different from the final value of dressings of old rags.

LAST WORD.

He who has not learned some scientific antiseptic method for wound treatment has not learned the first principles of surgery.

Men who have learned such a method will, after a series of brilliant results, begin to relax from the severity of their carefulness.

They will believe that certain details may be omitted.

Before long they have suppuration in a wound which they did not care to have suppuration in, or they fail to get primary union in a case where primary union was expected. As a result they will either lose a little of their faith in the infallibility of antiseptic measures, or they will, appreciating their position, reason back from effect to cause.

Whether a man screw himself up to the right key or not, depends upon the comprehensiveness of that man's intellection.

Remember that the relaxation from a condition of vigilance is sure to come.

Beware of failure to recover.